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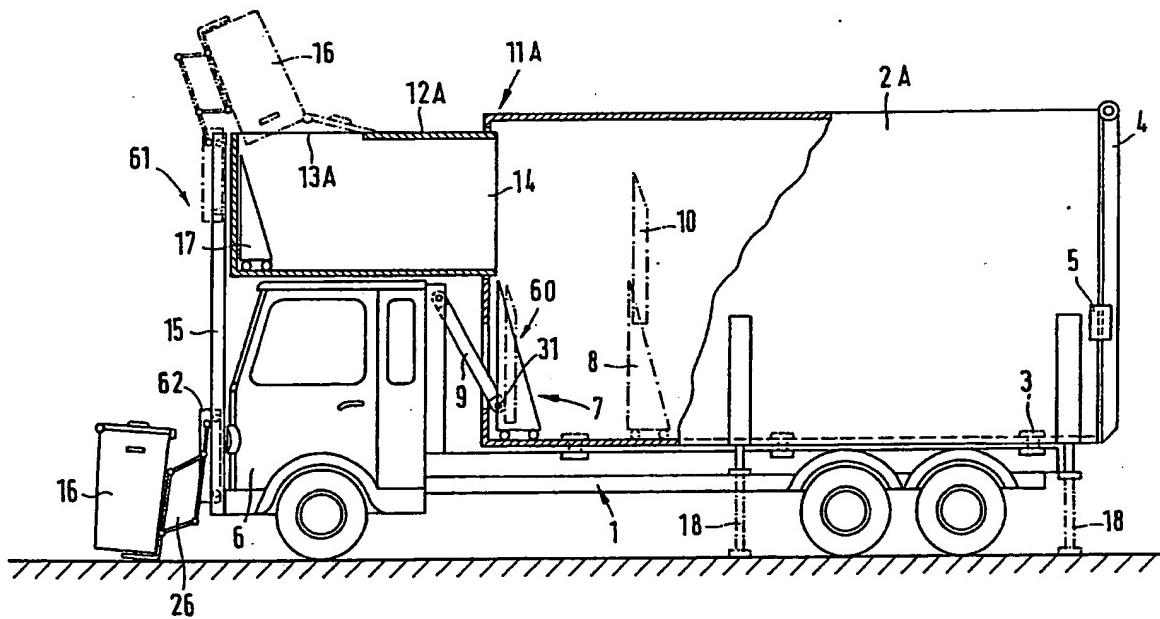


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(54) Title: TRASH COLLECTION VEHICLE



## (57) Abstract

The refuse collection vehicle has a collection container (2A) with an upper fill opening (14) and compacting means (7). An intermediate container (12A) adjacent the driver's cab has a fill opening (13A) and a discharge opening (14) communicating with the main container. Inside the intermediate container (12A) means (17) are provided for emptying its contents.

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TRASH COLLECTION VEHICLE

The present invention relates to a trash collection vehicle of the type which includes a collection container disposed behind an operator station, particularly behind the driver's cab of a motor vehicle. The collection container, which is preferably releasable from the vehicle, has a fill opening disposed in its upper region and at least one wall portion which can be opened for emptying, preferably the wall facing away from the fill opening. The type of trash collection vehicle to which the present invention relates also includes means for compacting the waste filled into the collection container.

A trash collection vehicle of the above-mentioned type is disclosed in U.S. Patent 3,202,305 to George R. Dempster and another. The trash containers are picked up from the ground at the front of the vehicle ahead of the driver's cab by a pair of pivot arms which are connected with the collection container. The trash containers are then pivoted high above the driver's cab and emptied into the fill opening of the collection container disposed behind the driver's cab by tipping them over. A significant drawback of these vehicles, known as "overhead loaders," is that during pivoting of the trash containers for emptying into the fill opening at the top of the collection container, the normal clearance profile of such vehicles is exceeded considerably. The term "clearance profile" as used herein means the height

of the vehicle at its highest point when trash is not being transferred.

U.S. Patent 4,096,959 to Georg Schäffler further discloses a trash collection vehicle in which a receiving hopper is disposed on the chassis between the driver's cab and the collection container, which is releasably connected with the vehicle. The trash containers are emptied into this receiving hopper by a pair of pivot arms which flip them over in the manner of an overhead loader. The trash is then moved by a shoveling device from the receiving hopper into the fill opening at the top of the collection container. Compaction of the trash in the collection container is not possible, so that optimum loading cannot be realized. Aside from the above described drawbacks of an overhead loader, this vehicle has the further drawback that the arrangement of the receiving hopper between the collection container and the driver's cab reduces the volume available for the collection container to a considerable degree.

U.S. Patent 3,643,824 to Harvie C. Partridge discloses a trash collection vehicle in which a receiving hopper is disposed between the driver's cab and the collection container, which is fixed to the chassis but is tilttable. The receiving hopper can be loaded manually from the ground with small trash containers or by way of an appropriate filling device. The trash disposed in the receiving hopper is then pushed by a pusher into the collection container.

through an opening disposed in the bottom region of the front wall of the collection container, and is substantially compacted. Large trash containers can not be emptied.

SUMMARY OF THE INVENTION

5 It is an object of the present invention to provide a trash collection vehicle of the above-mentioned type which utilizes the advantages known for an overhead loader, namely the fact that the workers are able to operate in front of the driver's cab in eye contact with the driver, and which avoids  
10 the drawbacks of the above-described systems, while permitting small-volume trash containers such as household trash cans to be emptied.

This is accomplished according to the invention in that, in the front region of the driver's cab, at least one  
15 intermediate container is disposed for receiving the trash from trash containers. This intermediate container is in communication with means for emptying the contents of the intermediate container into the fill opening at the top of the collection container. The intermediate container has a  
20 discharge opening separate from its fill opening. At least during the emptying process, the discharge opening of the intermediate container is in communication with the fill opening of the collection container.

An advisable further feature of the invention provides  
25 that the discharge opening of the intermediate container

and/or the fill opening of the collection container are closable. In this way it is possible for the intermediate container to have a closed configuration except for the mentioned openings. The arrangement of such an intermediate 5 container in the front region of the driver's cab has the advantage that the space behind the driver's cab is available for practically its entire length to accommodate the collection container, which can thus be of the largest possible size. The term "front region" in the sense of the 10 invention includes the space in front of the driver's cab as well as the space above the driver's cab.

A further advantage of a vehicle according to the invention, compared to conventional trash collection vehicles, is that its weight distribution is better, since 15 the weight of the components required for manipulating the trash containers and the intermediate container is absorbed by the front axle of the vehicle. Accordingly, the region at the rear axle is available to the fullest extent for accommodating the load provided by the filled collection 20 container. This results in better load distribution.

A further advantage of a trash collection vehicle configured according to the invention is that the intermediate container is emptied through an opening at the top of the collection container so that, in conjunction with 25 a compaction device such as a pusher, optimum filling of the collection container is possible. The filling from the top

is of particular significance for the compaction process since the quantities of trash received in the fill opening of the collection container by way of the intermediate container are pushed together against the opposite end wall and are  
5 compacted below the ceiling of the container. The compacting device is preferably configured in such a manner that it essentially covers the entire container cross section.

Sufficient space for maneuvering the vehicle must always  
10 be available in the direction of travel, so sufficient room is ensured for manipulating the trash containers, and eye contact can easily be established between the driver and the operating crew. The workers can give a signal to move on to the next pickup location, for example, once they have  
15 climbed onto the vehicle.

A trash collection vehicle according to the invention is of such design that it can be constructed to particular advantage on the basis of a mass-produced chassis. The trash collection vehicle may also be configured as a special  
20 vehicle with a so-called dropped frame design which has only a slight clearance above the ground. This makes it possible to provide a low lying driver's cab and/or a low lying chassis so that a relatively great height is available for the intermediate container and the collection container,

without exceeding the maximum permissible height during emptying. This makes a large capacity available.

A preferred feature of the invention provides that the intermediate container is in communication with at least one device for manipulating the trash containers to be emptied into it. Depending on the configuration and/or arrangement of the intermediate container, a device for manipulating trash containers may include a conventional, pivotable trash container holder mechanism, as they are employed for the manipulation of household trash cans having a volume between 50 and 240 liters and/or also for the manipulation of large containers having a capacity of 1 to 2 m<sup>3</sup>. While it is possible, in principle, to configure the intermediate container as an open container, it is advisable for it to be a closed structure having a closable fill opening that can be opened, for example, by way of the holder mechanism. If only a single intermediate container is provided, it may be connected with two or more holder mechanisms so that several trash containers can be emptied simultaneously.

The intermediate container may be subdivided into at least two container portions, with each container portion having an associated discharge opening. This permits discharge of sorted trash into the intermediate container for subsequent transfer to a collection container that is also subdivided in accordance with the invention. Each

container portion of the intermediate container may be connected with its own holder mechanism for the trash cans. It is also possible to provide two separate intermediate containers, which is of particular advantage for embodiments 5 which are equipped with a displacement apparatus for the intermediate container. In this case, each intermediate container has its own associated displacement apparatus and can be moved independently of the other.

If the collection container is subdivided, at least some 10 of the container portions may be releasably connected with one another. This has the advantage that, for example, household trash, which forms the major component of the collected trash load, can be dumped into a large basic container which acts as a supporting body for the releasable 15 container portions. Special trash can then be dumped separately and sorted into the container portions. For example, a large hospital or a remotely located treatment facility can be served in only one trash removal trip. The container portions with the special trash can then be 20 separated from the normal waste without any reloading being required. Glass or paper can also be transported away in a sorted manner together with the household trash if it is made available appropriately pre-sorted. If an intermediate container is provided, appropriate control at a displacement 25 apparatus according to the invention permits the intermediate container to then be moved directly toward individual

container portions of the collection container to be emptied thereinto.

A preferred feature of the invention further provides that the discharge opening of the intermediate container and/or the fill opening of the collection container are provided with an extension which projects into the respective other opening at least when the intermediate container is being emptied. This is advantageous particularly for trash collection vehicles in which the intermediate container and the collection container can be separated from one another according to the invention, since a proper seal is provided between the two mutually associated openings and no trash is able to escape to the outside. Moreover, such an extension which enters into the respective other opening makes it possible to seal the transition region.

As an advantageous feature of the invention, it is further provided that at least one wall portion extending transversely to the longitudinal axis of the collection container is displaceable in the longitudinal direction of the container and is in communication with an actuation mechanism (preferably operated hydraulically) which acts on the displaceable wall portion. The wall portion may be a container wall but it may also be a pressing plate or pusher which lies against the container wall. It is advantageous to mount the pusher at the end of the collection container facing the driver's cab because considerable savings in

weight for the container can be obtained since the actuation mechanism for the pusher can be arranged at the vehicle and no hydraulic components need be provided in the collection container for compacting the trash. Accordingly the entire

5       hydraulic system can be fixedly installed in the vehicle. A releasable coupling must be provided between the displaceable wall portion of the collection container and the actuation mechanism (preferably a telescoping hydraulic unit) if the collection container is configured to be releasable.

10      During operation, the actuation unit provides a forward and return movement required for compaction via the releasable coupling. Moreover, this has the advantage that relatively small trash collection vehicles which are able to move through narrow streets can be employed. Particularly for

15      this use, the arrangement of the intermediate container and its filling by way of the fill opening at the front region of the vehicle is of advantage because of its better maneuverability. A filled collection container can then be deposited by the trash collection vehicle while it is still

20      within its assigned region and an empty new container can be received as a replacement so that the trash collection vehicle and its operating crew need travel only in the collection area. The filled collection containers can then be transported away by other vehicles which are able to

25      transport several such collection containers by road or by railroad to more distant depositories. It is important that

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no reloading of the trash is necessary. Rather, the filled collection containers are merely set down one place and are then picked up again for further transporting. Depending on their size, the transporting vehicles can transport one or 5 more such collection containers, and a trailer filled with collection containers can be employed.

It is advisable for the collection container to be equipped with extendable ground supports. This makes it possible to employ a conventional truck chassis equipped for 10 operation with so-called interchangeable bodies for the above described transport of collection containers. Both filled and empty collection containers can be transported by vehicles designed for purely highway traffic. If, for example, the trash is driven to a waste incineration system, 15 a filled collection container can be deposited there on a tilting device, can be emptied, and can be picked up again by the transporting vehicle.

In one embodiment of a trash collection vehicle according to the invention, the intermediate container is 20 disposed above the driver's cab and a device for manipulating the trash containers or dumping device is configured as a pivotable holder mechanism and is equipped with a pick-up or elevating mechanism for the trash containers to be emptied, with such elevating mechanism 25 extending into the bottom region in front of the driver's cab. This arrangement has the advantage that a relatively

large capacity intermediate container can be employed. Two or more such dumping devices may be provided so that several trash containers can be manipulated independently and simultaneously. If the intermediate container is accessible from its frontal face, the tilting of the trash containers caused by the dumping can be effected in such a manner that the clearance profile is not exceeded substantially. During operation, the driver's view is not obstructed. The arrangement of the intermediate container above the driver's cab also permits the use of a driver's cab having a second seating bench for the operating crew so that, for longer trips between stops, for example in spread-apart residential areas, the crew is able to enter the vehicle from the front, that is, within the driver's viewing range.

As a further feature of the invention it is provided that the intermediate container above the driver's cab may be movable back and forth along a guide from a forward position into an emptying position at the collection container. This configuration is of advantage, in particular, if the collection container and/or the intermediate container are partitioned into several portions. The intermediate container can then directly approach the associated fill opening of the collection container. The guide may be configured in such a manner that one portion of the guide is disposed above the driver's cab and is fixed to the chassis and another portion of the guide is fixed to the collection container. This

advantage also exists if two independently movable intermediate containers are employed.

In another preferred embodiment of the trash collection vehicle according to the invention, a displacement apparatus for the intermediate container is connected with the vehicle so as to move the intermediate container over the driver's cab from a fill position on or near the ground in front of the driver's cab to the intermediate container's emptying position at the collection container. This configuration has the advantage, inter alia, that the dimensions of the intermediate container may extend almost over the entire width of the vehicle and approximately over the length of the driver's cab so that a large capacity intermediate container can be employed. In the fill position, this intermediate container can also be filled manually with trash bags and small trash containers. However, by way of an appropriate holder mechanism associated with the intermediate container, conventional trash containers can also be emptied. The particular advantage here is that little work needs to be performed to empty the trash containers into the collection container, and consequently the trash containers are emptied faster. Since the displacement apparatus permits the intermediate container to be brought close to the ground, the shortening of the lifting path connected therewith also simplifies the design of the holder mechanism. As soon as the intermediate container is filled completely, it is lifted

with the aid of the displacement apparatus to the height of the roof of the driver's cab. The intermediate container is then moved to the fill opening of the collection container behind the driver's cab and is there emptied with the aid of 5 its emptying means. Although the intermediate container is still in its emptying position, the trash collection vehicle is able to move on to the next pickup location. The intermediate container can then be moved back to its pickup position near the ground by the displacement apparatus. In 10 an arrangement where the intermediate containers can be moved independently of one another, each intermediate container has an associated displacement apparatus.

The displacement apparatus for the intermediate container may include a lifting mechanism disposed in front 15 of the driver's cab for an essentially vertical lifting movement, and a driving device for an essentially horizontal (and preferably longitudinal) movement above the driver's cab. This configuration has the advantage that the movement of the intermediate container is composed of only an 20 essentially vertical lifting component and a movement component in an essentially horizontal plane. In contrast to the large pivot arms of the prior art overhead loaders, the prescribed clearance profile is not exceeded any time during movement of the intermediate container. This makes it 25 possible to perform all functions without any obstruction even in covered entrances, under overhead streetcar contact

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lines, or under trees. The lifting mechanism may, for example, include a carriage which can be moved vertically up and down in front of the driver's cab by a lifting drive or by appropriately arranged pivot levers which raise the 5 intermediate container only to the level of the horizontal plane of movement. In this connection, it may also be advisable to provide a carriage guide for the basic movement of the carriage and, in view of minimum clearance with the ground, to perform the final movement during lowering of the 10 intermediate container to the ground region by means of pivot levers. The movement in the horizontal plane may be a pivoting movement by which the intermediate container is pivoted about a vertical axis above the driver's cab directly into its emptying position. If required, the intermediate 15 container can be pushed after the pivoting or it can be moved following the lifting movement by means of a horizontal pushing movement along a guide which extends to the region of the fill opening of the collection container.

As a further advantageous feature of the invention, 20 drive means are provided which move the intermediate container along the guide to the emptying position at the collection container and back again. This arrangement has the advantage that, in spite of the relative mobility of the intermediate container along the guide, the intermediate 25 container can be fixed in its direction of movement by way of the drive means and remain connected with the trash

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collection vehicle. The drive means may include, for example, horizontally acting hydraulic cylinders, revolving endless chains, or a driven carriage which receives the intermediate container. The underside of the intermediate 5 container may be guided while resting on the guides or, by way of appropriate connecting means, the intermediate container may be suspended from the guides at its upper side or laterally.

In a particularly advisable configuration of an arrangement which includes an open intermediate container, a pressure plate is displaceable along the horizontal guide so as to close the opening of the intermediate container when it is in the raised position. This has the advantage that, for example, if the intermediate container is loaded with bulky 15 trash or with trash bags, the intermediate container is closed for the horizontal movement following the lifting movement and thus no parts projecting from the bulky trash or trash bags are able to interfere with its operation. The pressure plate may be configured in such a manner that it also carries the intermediate container by way of releasable connecting means and thus forms a carriage which is in communication with the drive means, for example hydraulic 20 cylinders.

As an advantageous further feature of the invention, the 25 discharge opening of the intermediate container may be provided with a lockable closure. Actuating means for

opening the lock are disposed at the guide in the region of the emptying position at the fill opening of the collection container. If the intermediate container is subdivided into several container portions, each container portion may be 5 provided with an appropriate closure which can be opened only at the associated fill opening of the collection container.

The discharge opening of the intermediate container may be disposed at its rearward end, with a discharging apparatus which is movable toward the discharge opening 10 being provided as an emptying means in the intermediate container. This configuration of the intermediate container can be employed for an intermediate container which is fixedly disposed above the driver's cab or for an intermediate container that is movable by way of a 15 displacement apparatus. Depending on the configuration of the intermediate container, the discharging apparatus may also be employed to partially compact the trash in the intermediate container. For emptying, the discharging apparatus then pushes the trash through the discharge opening 20 into the fill opening in the upper region of the collection container. A discharging apparatus in the sense of the present invention may be a movable push plate as well as a rolling or scraper floor or a so-called push-rod floor in the intermediate container. The factor of primary importance in 25 this connection is that the quantities of trash falling into

the intermediate container are moved towards its discharge opening.

The discharge opening may alternatively be disposed at the bottom of the intermediate container. This arrangement 5 has the advantage that the displacement apparatus is able to bring the intermediate container to a position where it lies closely above a fill opening in the ceiling of the collection container. After the closure is opened, the trash is able to drop directly from the intermediate container into the 10 collection container. This arrangement is of particular advantage for intermediate containers that are subdivided into container portions and/or for subdivided collection containers since the intermediate container can be moved over the collection container until it reaches the associated 15 fill opening. By arranging appropriate sealing means at the lower edge of the intermediate container and/or at the edge of the fill opening of the collection container, for example in the form of a continuous rubber bead, a good seal can be obtained.

20 A further advantageous feature of the invention provides that the displacement apparatus may be disposed at a supporting frame which is connected with the vehicle chassis. The supporting frame carries the lifting mechanism in the front and carries the guide and the drive means for the 25 intermediate container in the region above the driver's cab. This arrangement has the advantage that the displacement

apparatus forms a closed system in itself which is releasably connected with the vehicle. Accordingly, after the displacement apparatus has been removed, it is possible to use the vehicle also for other transporting purposes.

5       A preferred feature of the invention provides that one end of the supporting frame, preferably the end in front of the driver's cab, is supported on the chassis at least two front fastening points. At its other end, preferably the end disposed behind the driver's cab, the supporting frame is  
10      supported at least by one rear fastening point, which is preferably disposed on the longitudinal center plane of the vehicle. The supporting frame is inherently rigid, and this arrangement permits the supporting frame to be fastened in such a manner that buckling of the chassis during operation  
15      is possible without adverse effects. Another advantage of this configuration is that the supporting frame can be fastened in the front region at the ends of the chassis that are easily accessible, and are configured on conventional trucks for the connection of additional assemblies.

20      The rear fastening point is preferably formed by a joint having at least two degrees of freedom. The joint may be, for example, a universal joint, a ball joint, or a flexible rubber joint.

Another feature of the invention provides that the rear  
25      fastening point may be releasable and the supporting frame may be mounted so as to be pivotal about a horizontal axis at

its front fastening points. This configuration permits so-called forward control vehicles, in which the drive motors lie partially within the driver's cab and the driver's cab can be pivoted forward for purposes of repair, to be used as 5 trash collection vehicles. If engine repair is necessary, the supporting frame can be pivoted forward to permit the driver's cab to be pivoted so that the engine can be repaired. It is particularly advisable for the supporting frame to be equipped with a controllable pivot drive, 10 preferably at least one hydraulic cylinder. In this way, the supporting frame can be pivoted completely forward to enable the driver's cab to be tilted as well. Furthermore the supporting frame can be pivoted by only a slight amount, so that sufficient free space is available for exchanging 15 collection containers. This results in the additional advantage that, assuming that the fill opening of the collection container is at the top, the fill opening of a collection container attached to the vehicle will be tightly sealed against the outside at the supporting frame in the 20 region of the transfer point when the supporting frame is lowered. In this connection, it is advisable for the supporting frame to be releasably connected with the chassis.

Another advantageous feature of the invention provides that, at least in the region extending over the driver's cab, 25 the supporting frame includes a guide which is enclosed on all sides except for an entrance opening for the intermediate

container and a transfer opening that can be connected to the fill opening of the collection container. This configuration has the advantage that, once the lifting movement has been completed, the intermediate container is conducted on its horizontal path in a manner encapsulated against the outside. There is a practically dust-tight seal toward the outside, and in particular the fill opening of the collection container is sealed in the emptying region for the intermediate container, and thus the intermediate container can be emptied without adversely affecting the environment.

Another advantageous feature of the invention provides that a cover may be disposed at the guide, with the cover at least partially enclosing the space in front of the driver's cab between the guide and the intermediate container, in its fill position on the ground. The length of this cover is variable to correspond to the lifting movement of the intermediate container. This has the advantage that, for intermediate containers that are open at the top, the trash containers can be emptied while the intermediate container is substantially shielded from the outside. The forward region of the cover, through which the trash container must be moved by the holding apparatus during dumping, is preferably configured as a strip curtain or the like. The strip curtain is mounted at the guide by way of a winding device so that its length can be shortened corresponding to the lifting movement. The side and rear regions of the cover may also be

formed by such windable curtains. However, a bellows which encloses the side and rear regions in a tightly sealing manner and which has an approximately C-shaped cross section is preferably used. The forwardly oriented free opening of 5 the C can then be closed by the above-mentioned strip curtain.

An expedient additional feature provides that the upper end of the cover is fastened to the pressure plate, which is movable back and forth along the guide in the manner of a carriage, and its lower end is fastened to the intermediate container. This arrangement has the advantage that the cover is affixed to the movable components only and is carried along when the pressure plate moves the intermediate container through the guide. 10

Another feature of the invention provides that the intermediate container may be exchangeably connected with the displacement apparatus. This arrangement has the advantage that such intermediate containers can be employed as large-volume trash containers, for example, for special types of 15 refuse or bulky refuse. The trash collection vehicle merely picks up the set-down intermediate container, empties it into the collection container of the vehicle, and sets it back down at the pickup location. 20

A further feature of the invention provides that the displacement apparatus, particularly if it includes a lifting mechanism, may be connected with a pulverizing device 25

and/or a pressing device. This arrangement permits a trash collection vehicle according to the invention to be used for picking up bulky refuse. The advantages of a trash collection vehicle with a releasable collection container can thus 5 also be utilized to advantage for the collection of bulky refuse.

As a further feature of the invention, the arrangement of the intermediate container in conjunction with a displacement apparatus which allows an essentially 10 horizontal movement of the intermediate container over the driver's cab permits the device for manipulating the trash containers to be provided in the form of a controllable pickup and emptying device which is disposed in the front region of the driver's cab. Such a device, which may be 15 constructed in the manner of a so-called robot arm as it is employed in industrial manufacturing, permits the operation of the trash collection vehicle to be simplified since all functions can be controlled by the driver in the vehicle, particularly by a second operator, without their movements 20 overlapping.

The pickup device may be mounted so as to be pivotal about a vertical pivot axis and it may include a gripping and dumping device for the trash containers to be emptied. This gripping and dumping device is pivotal about at least one 25 coordinate axis and is held at an arm at a variable distance from the pivot axis. With such a pickup device, trash

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containers of all different sizes and in any kind of arrangement can be picked up directly, for example from the edge of the road, and emptied.

Another advantageous feature of the invention provides 5 that, in the region between the driver's cab and the front end of the trash collection container, a protected worker station may be provided on least at one longitudinal side of the vehicle. This configuration has the advantage that the worker can step onto the vehicle in the immediate vicinity 10 of the driver's cab, still in eye contact with the driver.

The worker can ride along to the next pickup location without having to enter the driver's cab. This is of particular advantage in communities where the pickup points for the trash containers are located at distances which are a 15 multiple of the length of the vehicle. In such cases, the worker can traverse these greater distances while sitting or standing on the vehicle. The worker station may be provided with a cover as protection against the weather, and additional safety means may be provided which protect the 20 worker from falling out as a result of abrupt vehicular movements, such as emergency braking.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view, partially in section, showing 25 an embodiment of a trash collection vehicle having a stationary intermediate container.

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Figure 2 is a side view, partially in section, showing a further embodiment which includes a stationary intermediate container.

5 Figure 3 is a side view, partially in section, showing an embodiment having a movable intermediate container.

Figure 4 is a side view, partially in section, showing an embodiment which includes a displacement apparatus having a lifting mechanism for the intermediate container.

10 Figure 5 is a side view, partially in section, showing a modification of the embodiment of Figure 4.

15 Figure 6 is a side view, partially in section, showing an embodiment which includes a displacement apparatus having a lifting mechanism for the intermediate container and which includes additional manipulating devices for the trash containers.

Figure 7 is a top view schematically illustrating a subdivided collection container.

20 Figure 8 is a side view showing a further embodiment, which includes a tilttable supporting frame for a displacement apparatus.

Figure 9 is a side view showing details of a portion of the displacement apparatus for the embodiment of Figure 8.

25 Figure 10 is a side view, partially in section, showing an embodiment having a horizontally pivotal intermediate container.

Figure 11 is a top view of the embodiment of Figure 9.

Figure 12 is a sectional view, taken along line XII-XII of Figure 13, showing a longitudinally divided collection container.

5 Figure 13 is a sectional view, taken along line XIII-XIII of Figure 12, of the longitudinally divided collection container.

Figures 14A to 14G are schematic side views showing a sequence of steps when trash is collected with a modification of the vehicle shown in Figure 8.

10 Figure 15 is a perspective view of a collection container for three different materials.

Figure 16 is a schematic side view of a lifting device for the intermediate container.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a simple embodiment of a trash collection vehicle, primarily in order to describe the basic structure and functions of the present invention. A 5 collection container 2A is releasably fastened on a chassis 1, for example by locking members 3 as they are customary in container transporting vehicles. The rear of collection container 2A is configured as a discharge opening and therefore includes a pivotable rear wall 4. Rear wall 4 can be 10 pivoted open toward the top, and it can be held in the closed position by locking members 5.

The trash collection vehicle is provided with a pressing apparatus 60 which includes a pressing plate or pusher 7. Pusher 7 is disposed in the interior of container 2A, 15 normally adjacent the end wall of container 2A that faces the driver's cab 6, and is guided so as to be displaceable within collection container 2A in the longitudinal direction of the container 2A. Pusher 7 is movable by an actuation mechanism 9, for example a telescoping hydraulic cylinder, which is 20 releasably connected with pusher 7 by a coupling 31. An opening is provided in the front end wall of collection container 2A as shown, and the coupling 31 is manually accessible through this opening. When collection container 2A is completely filled, as will be discussed in more detail

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hereafter, this opening is closed by pusher 7. Actuation mechanism 9 may be permanently disposed in collection container 2A as an alternative.

Pusher 7 has two primary portions. It includes a base member 8, to which the actuation mechanism 9 can be connected, and an extension member 10 which can be raised vertically upwardly so that the pusher 7, with its extension member 10 raised, covers almost the entire container cross section as shown in dot-dash lines. In its end position at 10 the front wall and with extension member 10 lowered, collection container 2A has a fill opening 11A in its upper region. This fill opening 11A can be closed by extension member 10.

An intermediate container 12A is permanently mounted 15 above driver's cab 6 and is provided with a fill opening 13A in its forward region. The intermediate container 12A extends essentially over the entire width of driver's cab 6. At its rear end 14, intermediate container 12A has a discharge opening which corresponds in size to fill opening 20 11A of collection container 2A. The rear end 14 of intermediate container 12A extends slightly into collection container 2A and bridges the gap between the end wall of intermediate container 12A and the rear wall of driver's cab 6.

With continuing reference to Figure 1, a dumping apparatus 61 is disposed at the front of driver's cab 6 as an apparatus for manipulating the trash containers 16. Dumping apparatus 61 includes a holder mechanism 26 which is

5 pivotably mounted on a carriage 62. Holder mechanism 26 cooperates with elements (not illustrated) on trash container 16 so as to releasably grip the trash container 16. Carriage 62 is provided with rollers which extend into channels in a pair of guide rails 15 that are mounted on the vehicle.

10 Guide rails 15 are part of a trash container elevating mechanism which also includes a drive mechanism (such as hydraulic cylinders, not shown) for raising or lowering carriage 62 along rails 15 and a further drive mechanism (such as further hydraulic cylinders, not shown) for rotating

15 holder mechanism 26 with respect to carriage 62 when carriage 62 is at the top of the rails 15. After the trash container 16 is manually placed on holder mechanism 26, dumping apparatus 61 raises it from ground level to the region above intermediate container 12A, and then holder mechanism 26 is

20 pivoted with respect to carriage 62 so as to empty trash container 16 into intermediate container 12A. Fill opening 13A is shown only schematically. The fill opening 13A is advisably provided in the intermediate container 12A in such a manner that, in conjunction with the dumping apparatus 61,

the pivoting of trash container 16 into the discharging position causes the clearance profile of the vehicle (that is, the normal height of the vehicle) to be exceeded at most only slightly.

5 Two (or more) dumping apparatuses may also be arranged next to one another and actuated independently of one another so that two trash containers 16 can be emptied simultaneously, although this is not shown in Figure 1.

The trash emptied into intermediate container 12 is then  
10 pushed by a discharging apparatus 17 in intermediate container 12A through fill opening 11A and into collection container 2A. The discharging apparatus 17 is illustrated only schematically and may include a pusher as shown, in addition to associated equipment such as guides (not shown)  
15 for the rollers of the pusher and a hydraulic cylinder (not shown) for moving the pusher back and forth along the guides. Alternatively, a conveyor belt (not illustrated) or floor scraper (not illustrated) which moves the incoming trash into collection container 2A could be employed for discharge  
20 apparatus 17.

At appropriate intervals, pusher 7 pushes the trash which has been discharged into the collection container 2A toward rear wall 4 so that, once the trash in container 2A reaches a certain fill volume, the trash is pressed against

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the rear wall 4 and thus compacted. Sufficient free fill space is thus made available below fill opening 11A for each new discharge process from intermediate container 12A. In the final phase, a small remainder can then be squeezed by 5 discharge apparatus 17 of intermediate container 12A into the region of collection container 2A immediately adjacent fill opening 11A, whereupon extension member 10 is raised to close the fill opening 11A completely.

The collection container 2A, which is thus filled 10 tightly and almost completely with trash, can then be driven to a depositing location and can there be set down by the vehicle. In the embodiment illustrated in Figure 1, telescoping supports 18, which can be extended downward and locked, are provided for this purpose on the exterior of 15 collection container 2A. After the extension of supports 18, locking members 3 are released. Depending on the type of the collection container, the locking members are raised somewhat before the supports 18 are locked or the vehicle is lowered somewhat after the supports 18 are locked, for 20 example with the aid of the vehicle's air suspension (not illustrated). The vehicle can then move out from underneath the thus set-up collection container 2A and pick up a likewise supported empty collection container before returning to its assigned area. The filled collection con-

tainers 2A can then be picked up by a purely transporting vehicle (not illustrated) and driven to an unloading location, be it an incineration plant or some other depository such as a dump landfill.

5       The modified embodiment shown in Figure 2 corresponds generally to the embodiment of Figure 1. Here, intermediate container 12B extends rearwardly beyond driver's cab 6 and covers a recess in collection container 2B. The plane of fill opening 11B of collection container 2B thus extends  
10      horizontally, and the associated discharge opening of intermediate container 12B is disposed in the bottom, in alignment with fill opening 11B. Trash is pushed through these openings by discharging apparatus 17.

Figure 3 shows a further modification. Here, intermediate container 12C is mounted above driver's cab 6 in a horizontally displaceable manner, as by being suspended from a guide 20 which is mounted on the vehicle. A guide 34 which follows guide 20 is mounted on the ceiling of collection container 2C, so that a drive mechanism (not shown) is able to move intermediate container 12C into collection container 2C through fill opening 11C.  
15      Intermediate container 12C can be emptied, for example, through a flap (not shown) in its bottom. In this embodiment, the intermediate container 12C is filled in the  
20

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manner described above. Guide 20 may also be disposed directly on the roof of driver's cab 6 so that the intermediate container 12C enters into guide 34 only when it enters into the collection container 12C for the emptying process.

Figure 4 shows an embodiment in which intermediate container 12D can be moved from a fill position near the ground in front of the driver's cab 6 to a raised position in front of and over the driver's cab 6, and then to an emptying position at collection container 2D. Intermediate container 10 12D is shown in dot-dash lines in its emptying position.

Although not shown in Figure 4, intermediate container 12D is emptied by a discharging apparatus 17 as described, for example, in connection with Figure 1. Collection container 15 2D itself is very similar to the collection container 2A in the Figure 1 embodiment, except that an overhang 59 is mounted at the front end wall of collection container 2D to reduce the risk that trash might fall between the front end wall and pusher 7.

20 In the illustrated embodiment, a displacement apparatus 19 includes a guide 63 which is mounted on the vehicle above driver's cab 6. This guide 63 may be provided, for example, in the form of two parallel rails which are spaced apart and which rollers hold 21 that are connected to intermediate

container 12D. Alternatively, the rails may hold slides (not shown) connected to intermediate container 12D, or a carriage (not shown) that can be connected to intermediate body 12D.

Displacement apparatus 19 also includes a lifting mechanism 22 which moves intermediate container 12D vertically. Lifting mechanism 22 includes vertically extending guides 23 in which a lifting frame 24 can be moved vertically up and down with the aid of a lifting drive 25, for example in the form of hydraulic cylinders or rapid thrust spindle drives (not illustrated) driven by an oil motor (not illustrated). Lifting frame 24 is provided with the appropriate rails for receiving intermediate container 12D.

A holder mechanism 26 of conventional construction may be disposed at the front of lifting frame 24 for emptying trash containers into intermediate container 12D. Trash bags may be thrown manually into fill opening 13D.

Displacement apparatus 19 also includes drive means for advancing intermediate container 12D, in the raised position as shown in Figure 4, by way of guide 63 into its emptying position, and for retracting it again. In the illustrated embodiment, a hydraulic cylinder 27 is provided as the drive means. It is fastened to lifting frame 24 and engages the bottom region of intermediate container 12D. However, the

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drive means may also be disposed in the region of guide 63 and if a hydraulic cylinder is employed, for example, its piston rod can be retracted to draw intermediate container 12D to the emptying position. Thus intermediate container 5 12D can be pressed against collection container 2D and locked (it being noted that the emptying position of intermediate container 12D is also its position when the vehicle is being driven).

The rear wall of intermediate container 12D is closed by 10 at least one lockable flap 28. In the region of the emptying position, shown in dot-dash lines in Figure 4, guide 63 is equipped with actuating means, for example in the form of hydraulic cylinders (not illustrated). When the intermediate container 12D is moved to the emptying 15 position, the actuating means is engaged and releases the lock (not illustrated) of flap 28 and/or opens flap 28. By way of a discharging apparatus disposed in intermediate container 12D but not shown in Figure 4, the trash can now be pushed out of the intermediate container 12D and into 20 collecting container 2D.

Figure 5 shows a modified version of the embodiment of Figure 4. The displacement apparatus corresponds essentially in structure and function to the displacement apparatus 19 in the embodiment of Figure 4. The difference in the Figure 5

embodiment is that the end of collection container 2E facing driver's cab 6 has a stepped region at the height of intermediate container 12E, with a fill opening for container 2E. Guide 63' extends over the stepped region of collection 5 container 2E so that the intermediate container 12E can be moved to a position above the fill opening. The guide 63' may be fastened to the vehicle over its entire length, but it is preferable to divide guide 63' (or rather the parallel rails which form it) into a forward portion which is 10 connected to the vehicle over driver's cab 6 and a rear portion which, in a manner corresponding to the embodiment of Figure 3, is fastened to the collection container 2E over the fill opening of the collection container 2E. In this embodiment, intermediate container 12E has a front-end fill 15 opening 13E. More importantly, intermediate container 13E has bottom flaps 29, shown in dot-dash lines, which can be unlocked and opened to empty intermediate container 12E into collection container 2E. After intermediate container 12E has been emptied, the flaps 29 are locked again by an 20 appropriate actuating means (not illustrated). The pusher 7 is moved back and forth over this region of collection container 12 by actuation mechanism 9 to keep the region clear.

In the embodiments of Figures 1, 2, 3, 4 and 5, the collection container (for example, reference number 2A in Figure 1) includes, at its fill opening (for example, reference number 11A in Figure 1), a closing flap (not illustrated) which is closed tightly as soon as the collection container is to be released from the vehicle when filling is completed.

The embodiment shown in Figure 6 depicts a collection container 2F which is subdivided by a partition 64 into two portions 33 and 33' and which is provided with two fill openings on its upper side. Guide 65 has a rear portion 58, for example in the form of rails, which is firmly connected with the collection container 2F so that collection container 2F may be releasably connected with the chassis 1. The collection container might alternatively be configured according to Figure 3 (that is, so that the intermediate container 12F is able to move into it through an opening).

Both end walls of collection container 12F can be opened by pivoting a respective wall 4. The fill in container portion 33 can be compacted by pusher 30 and the fill in container portion 33' can be compacted by pusher 30'. Pushers 30 and 30', which are connected by hydraulic cylinders (not illustrated) to partition 64, can also be used to push out the compacted trash after the respective wall 4

has been opened. With collection container 2F, pre-sorted trash can be collected with a single vehicle. The collection container can, of course, be partitioned in various different ways. If there are more than two transverse partitions, the 5 collection container may be emptied through respective openings in the side wall. It is also possible to partition it longitudinally. In this case, the intermediate container must be provided with appropriately associated discharge openings. If the partitioning is longitudinal, the collec- 10 tion container can be emptied and its fill compacted by means of several parallel, independently guidable pushers. The container portions may, as shown, form a closed unit. Alternatively, they may be configured as separate containers which can be connected with the chassis 1 so as to be 15 individually releasable. Each container portion may here be equipped with its own pusher whose hydraulic cylinder can be connected with the hydraulic supply of the vehicle by a plug-in connection.

Figure 12 is a schematic top view and Figure 13 a cross- 20 sectional view of such a longitudinally divided collection container, which is identified using reference number 2G. Each of the container portions has a respective pressing apparatus with a pusher, identified here as pushers 66, 67, and 68. For reasons of better weight distribution, the

container portion intended for the type of trash occurring in larger quantities may be arranged in the middle. Instead of a single longitudinally partitioned collection container such as container 2G, separate elongated collection containers 5 (not illustrated) which can be releasably connected with one another and with a base frame may be employed.

Figure 7 is a schematic top view of a collection container 2H which includes a basic container 2a', which simultaneously constitutes a base or supporting frame for 10 container portions which are provided by individual containers 2b', 2c' and 2d'. The individual containers 2b', 2c', and 2d' are releasably connectable with basic container 2a'. The basic container 2a' and the individual containers are provided with fill openings (not illustrated) through 15 which pre-sorted trash can be dropped from an intermediate container 2F that is movable on the rails of guide 58 (see Figure 6). Depending on the particular case, the container portions may be provided with fill openings which can be charged independently of the intermediate container 2H, for 20 example in a respective side wall. For example, paper could may be deposited in individual container 2b', while special refuse, for example from hospitals, could be filled into individual containers 2c' and 2d'. The individual containers can then be released from the collection container 2H or from

the vehicle for emptying, and can be transported away without being reloaded while the normal trash contained in basic container 2a' is dumped in the usual manner.

Returning to Figure 6, a dumping apparatus 35 is provided in the form of a robot-type arm for manipulating trash containers 16 to be emptied into intermediate container 12F. Dumping apparatus 35 is connected with the vehicle or, more precisely, with the guide 65, so as to be pivotal about a vertical axis 36. Dumping apparatus 35 includes an arm section 37 whose length can be varied horizontally, as by using a hydraulic cylinder, as well as an arm section 38 whose length can also be varied. Arm section 38 is pivotably articulated to arm section 37. With dumping apparatus 35 the clearance profile of the vehicle (that is, the vehicle's normal height) is not exceeded by very much during manipulation of trash container 16 and intermediate container 12F. A gripper mechanism 39 (shown only schematically) is disposed at the free end of arm section 38 and is itself pivotal relative to arm section 38 about at least one coordinate axis so that practically any type of trash container can be picked up from the edge of the road, precisely positioned in front of intermediate container 12F, emptied into it by pivoting the gripper mechanism 39, and put down again. Such a gripper mechanism 39 can be operated from the driver's cab or from an

operating station (not illustrated in Figure 6) disposed on the side of the vehicle. Gripper apparatus 39 is equipped with means (not illustrated) for opening and holding the cover of the trash container 16 during the emptying process.

5 If configured appropriately, a gripper apparatus is able to also pick up trash bags and smaller bulky pieces of rubbish. Advantageously, if the gripper apparatus is pivotal about all three coordinate axes, it will be able to pick up trash containers standing at an angle to the edge of the road.

10 In all embodiments, the intermediate container can be closed completely (although the closure is not illustrated in some of the drawings). For example, a flap 28 as in Figure 4 or flaps 29 as in Figure 5 may be used to close the discharge opening. The intermediate container may also be provided  
15 with a closable fill opening for the trash containers to be emptied, with such opening being opened only during emptying of the trash container. This may be accomplished by using one or more covering flaps (not illustrated) for the fill opening. The fill opening of the intermediate container  
20 may also extend over almost the entire length of the ceiling of the container.

Returning to the embodiment of Figure 4, instead of a holder mechanism 26, a pulverizing machine (not illustrated) may be disposed at lifting frame 24. With an appropriately

configured intermediate container 12D (such as a container that is open at the top, not illustrated in Figure 4) such a trash collection vehicle may also be used for collecting bulky rubbish. The intermediate container 12D could be  
5 emptied into collection container 2D after displacement, either through an appropriate discharging mechanism (not illustrated in Figure 4), through bottom flaps (not illustrated in Figure 4), or by dumping.

In the embodiment shown in a side view in Figure 10 and  
10 in a top view in Figure 11, intermediate container 12I is fastened to a lifting column 69 with which the intermediate container 2I can be raised to above the height of the driver's cab 6. The subsequent horizontal movement into the emptying position is performed by pivoting about the axis of  
15 lifting column 69, so that intermediate container 2I is moved in a horizontal plane, as can be seen in Figure 11.

In modification of the embodiment shown in Figure 10, lifting column 69 may also be disposed in the middle in front of the driver's cab 6; the intermediate container 12I  
20 can still be brought into its emptying position at the collection container 2I by a pivoting movement in the horizontal plane.

Depending on the dimensions of the intermediate container 12I and the driver's cab 6, the pivoting process

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may also be followed by a horizontal pushing movement. This is advisable, for example, in order to produce a tight connection between the intermediate container 12I and the fill opening of the collection container 2I.

5       The embodiment shown in Figures 10 and 11 can also be modified, with respect to the horizontal displacement movement, so that the intermediate container 12I is pushed into the collection container 2I after the pivoting process, in a manner similar to that shown in Figure 3. Furthermore, 10 if a partitioned collection container according to Figure 7 is employed instead of collection container 2I, after pivoting the intermediate container 12I can be moved, by way of guides 58 on or at the container, to a position above the fill opening of the appropriate container portion. For a 15 longitudinally partitioned container as shown in Figures 12 and 13, the pivoting process is advisably followed by shifting the intermediate container 12I in the transverse direction above the driver's cab 6 so that the intermediate container 12I can be emptied into the appropriate container 20 portion. The intermediate container 12I may be provided with a holder mechanism 26 as in Figure 4 or with some other manipulating mechanism, for example in the form of a robot arm as in Figure 6.

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The most desirable embodiments including a movable intermediate container are embodiments in which, after the lifting process, the intermediate container is moved only in a horizontal plane, so that at no time is the greatest 5 permissible height exceeded.

Figure 8 shows a further embodiment in which displacement apparatus 19'' includes a closed supporting frame 70 which is connected with vehicle chassis 1. Supporting frame 70 is provided with a guide 71 above driver's cab 6 and with 10 drive means (not illustrated) for moving intermediate container 12J horizontally. Intermediate container 12J has an open top as its fill opening. Displacement apparatus 19'' also includes a lifting mechanism 72 (which is not shown in Figure 8 and will be described later with reference to Figure 15 9) for the intermediate container 12J. Vertically extending guides 23' for the lifting mechanism 72 are rigidly connected to guide 71, which includes a shielded portion 73 and an open portion 74. The open portion 74 of guide 71 extends forward of the guides 23'. The shielded portion 73 of guide 71 is 20 configured in the form of a rectangular channel that is closed on four sides and that extends from guides 23' to a transfer region 40 above fill opening 11J of collection container 2J. Transfer region 40 is tightly connected at its bottom by way of an intermediate seal 41 with the fill

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opening 11J of collection container 2J. With the aid of the drive means (not illustrated), for example an endless revolving chain drive mechanism extending horizontally in guide 71, intermediate container 12J can be moved back and forth along guide 71 by a carriage 42 which is configured as a cover plate. The drive means may alternatively be a hydraulic cylinder corresponding to hydraulic cylinder 27 in the embodiment of Figure 4, except that the cylinder is advisably fixed, together with carriage 42 and the piston rod, at the rear end of the guide 71. In the emptying position, which is simultaneously the driving position, the piston/cylinder unit would then be pushed together. The horizontal movement of the intermediate container 12J can also be effected by means of other drive systems, for example oil motors (not illustrated) or electric motors (not illustrated). The width of the rectangular channel provided by shielded portion 73 is such that it is able to accommodate intermediate container 12J together with its carriage-like cover plate 42. Rear wall 40' is closed.

The supporting frame 70 of displacement device 19'' is articulated to the front end of the vehicle chassis at two fastening points 43. It is also supported on an abutment 75 for actuating mechanism 9 at a fastening point 44, so that a three-point support is provided. Fastening point 44 is

configured as a joint so that vehicle chassis 1 is able to freely buckle relative to the supporting frame 70, which is inherently rigid. The fastening point 44 may be a universal joint which permits transverse displacement of the abutment 5 75 relative to the supporting frame 70.

A hydraulic cylinder 45 is connected on each side of supporting frame 70. The hydraulic cylinders 45 can raise the supporting frame 70 by a slight amount from the illustrated horizontal position (the operating position) so 10 that fill opening 11J is exposed and collection container 2J can be separated from the vehicle. Hydraulic cylinders 45 are dimensioned in such a way that they can also pivot displacement device 19'' forward into the position shown in dot-dash lines. This permits driver's cab 6 to also be 15 pivoted in the conventional manner to the position shown in dot-dash lines so that repair or maintenance work can be performed on the vehicle engine.

The mode of operation of the displacement apparatus 19'' of Figure 8 otherwise corresponds to that of displacement 20 apparatus 19 described in connection with Figure 4 and displacement apparatus 19' described in connection with Figure 5. The trash containers (not shown in Figure 8) are emptied by way of a holder mechanism (not shown in Figure 8) into the intermediate container 12J, which is shown in Figure

8 in dot-dash lines in its fill position near the ground. Then, by way of the lifting mechanism 72 (see Figure 9) the intermediate container 12J is lifted until it abuts against the carriage 42 and is locked to it. Thereafter, the drive means (not illustrated) provided in guide 71 moves the carriage 42 together with intermediate container 12J out of the lifting mechanism into the shielded portion 73 of guide 71, and then to the emptying position. Here a closing flap (not illustrated in Figure 8) which forms the rear wall of the intermediate container 12J opens and the trash contained in intermediate container 12J is pushed out by a discharging apparatus 17 (which may, for example, be driven by a hydraulic cylinder as shown) into transfer region 40 and drops into collection container 2J through fill opening 11J.

15 Inside collection container 2J, pusher 7 pushes the trash into the rear portion of collection container 2J. Pusher 7 is advanced by actuation mechanism 9 (such as a hydraulic cylinder) until it has swept over the region beneath fill opening 11J, which lies in a portion of collection container 20 12J having a relatively low ceiling. Due to the relatively low ceiling, the forward portion of collection container 2J has a smaller container cross section than the rest of collection container 2J. The trash is pressed from the region of the small container cross section to the region of ,

the large container cross section and almost completely fills the larger cross section region of collection container 12J due to the structure of the trash in the final filling phase.

5       The shielded portion 73 of guide 71 encloses intermediate container 12J during its horizontal range of movement, all the way to the transfer region 40. This keeps trash from being blown out through the open top of intermediate container 12J. In any event intermediate  
10      container 12J is closed by carriage 42 during the horizontal movement. The lifting mechanism 72 shown in Figure 9 may be used in order to also shield intermediate container 12J against the outside during the vertical lifting movement.

Like the lifting mechanism 22 in Figure 4, the lifting  
15      mechanism 72 shown in Figure 9 includes a lifting frame 24 which is mounted on guides 23' for up and down movement. Lifting mechanism 72 also includes a lifting drive, although this is not shown in Figure 8 for the sake of clarity. A lifting drive 25 as described in conjunction with Figure 4  
20      may be used. Unlike the Figure 4 embodiment, lifting mechanism 72 also has a variable length cover 46. Cover 46 includes a bellows 47 which has a basically C-shaped cross section and encloses the lifting region on the sides and toward the driver's cab 6. Bellows 47 is open toward the

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front, with respect to the direction of travel. This opening is closed by a strip curtain 48. The bottom end of bellows 47 is fastened to intermediate container 12J and the top end is fastened to carriage 42. After it has been completely 5 filled, intermediate container 12J is raised by lifting frame 24 and pressed against carriage 42, and while this occurs bellows 47 is pushed together and is partially received by recesses 49 in carriage 42. The bottom end of strip curtain 48 is fastened to a handle 76 which can be removably clipped 10 onto intermediate container 12J. The top end is attached to a winding mechanism 50 that is connected to carriage 42. Since at least part of the front region of cover 46 can be opened, the trash container (not illustrated in Figure 9) to be emptied can be moved through with the aid of a holder 15 mechanism 26 so as to empty it into the upwardly open intermediate container 12J without noticeable quantities of dust or refuse escaping. As soon as intermediate container 12J is locked to carriage 42, the entire system including cover 46 can be moved to the emptying position shown in 20 Figure 8. Lifting frame 24 remains in the raised position.

In the fill position of intermediate container 12J near the ground as shown in Figure 9, cover 46 obstructs the driver's view immediately toward the front. However, this generally does not matter since the lifting mechanism 72 of

displacement device 19 is able to quickly raise intermediate container 12J and lifting frame 24 and thus enable the driver to see again. If small trash containers are to be emptied at different stops along a relatively long route, the

5 intermediate container 12J may have to be moved up and down several times to enable the vehicle to move on before it is completely filled. On the other hand if large trash containers are to be emptied, for example at multi-family dwellings, or if a large number of smaller trash containers

10 are set out next to one another, the intermediate container 12J is generally filled completely at one pickup location and can then be emptied into the vehicle as the vehicle is driven to the next pickup location during the horizontal movement and during the emptying process.

15 If bags (not illustrated) are to be employed for the trash, instead of trash containers, and if such bags are to be dropped into the open top of intermediate container 12J without being emptied, it would be desirable for carriage 42 to include a pressure plate which is actuated when

20 intermediate container 12J is in the raised position to compress its contents. Such a pressure plate would be carried along by carriage 42 during the horizontal movement of intermediate container 12J until the latter has reached its emptying position above the collection container 2J.

Instead of a separate pressure plate, however, the fill opening at the top of the intermediate container 12J may be closable with flaps (not illustrated) which are fastened to intermediate container 12J. In embodiments without cover 5 46, such flaps could be folded open enclose the fill opening on three sides to thus form a protection shield against the wind during emptying of the trash containers into the intermediate container 2J.

As can be seen from Figure 8, a space exists between 10 the rear of driver's cab 6 and the front wall of collection container 2J and outward of the abutment 75 for actuation mechanism 9. This space is sufficient for a protected worker station where the worker can stay during travel between two relatively distant pickup locations for trash containers. A 15 ladder 51, which is provided to permit convenient access to the upper regions of the vehicle, is mounted by hinges (not illustrated) on one side and has a latch (not illustrated) on the other side. This permits the ladder 51 to also serve as a latchable door to the worker station, ensuring that the 20 worker will not be flung out of the worker station.

Although not shown to avoid obscuring the drawings, the worker station may also be provided with walls at the top and on three sides to protect the worker against the weather during his stay at this location. At the same time, the

worker has a secure position here during travel even if the vehicle is forced to brake suddenly.

Figures 14A to 14G show, for better understanding, the sequence of the individual functions with reference to a vehicle of the general type shown in Figures 8 and 9. Some of the elements shown in Figures 8 and 9 are not depicted in Figures 14A to 14G to avoid obscuring the drawings, and it should be noted that the holder mechanism 26' and the ladder 51' in Figures 14A to 14G are modified forms of the holder 26 and the ladder 51 in Figures 8 and 9. Additionally, the vehicle shown in Figures 14A to 14G has horizontal hydraulic cylinders 45' for pivoting the supporting frame instead of the vertical hydraulic cylinders 45 shown in Figure 8.

Figure 14A shows the emptying of a large trash container 16' into the intermediate container 12J, which is in a position near the ground. The space above the intermediate container 12J is enclosed by cover 46 so that trash container 16' can be pivoted into this area through the strip curtain.

Figure 14B shows the lifting process.

Figure 14C shows the displacement of intermediate container 12J in the channel-like guide 71 until it reaches the emptying position. Lifting frame 24 is held in the raised position.

Figure 14D shows the emptying of intermediate container 12J into collection container 2J, with a rear closing flap 77 on intermediate container 12J releasing the discharge opening of intermediate container 12J.

5 Figures 14E and 14F show the return movement of intermediate container 12J. Figure 14F also shows the pushing of the trash to the rear region of collection container 2J by pusher 7.

Figure 14G shows the vehicle with displacement apparatus 19' pivoted slightly forwardly and with ground supports 18 extended from collection container 2J. By lowering the vehicle relative to the collection container 2J in the manner customary for interchangeable bodies, the vehicle is released from the collection container 2J and is able to move forward.

10 15 A new, empty collection container can now be picked up in the reverse sequence. If maintenance and/or repair work is required for the engine, the displacement can be pivoted further into the position shown in Figure 8.

In the embodiment shown in Figures 14A to 14G, the stationary ends of the hydraulic cylinders 45' are articulated to the upper portion of abutment 75. This has the advantage, inter alia, that more space is available for the worker station behind ladder 51', in comparison with the arrangement shown in Figure 8.

The vehicle can be driven only if the intermediate container has been raised. Although not shown, this can be accomplished by additional safety means which are connected with the controls for the displacement apparatus, for example 5 in the form of a so-called interlock which permits release of the brake only if the intermediate container has been raised.

Figure 15 is a perspective view of a collection container 2K for use with a vehicle according to Figure 8 in lieu of collection container 2J if pre-sorted trash is to be 10 collected as described already in connection with Figures 12 and 13. Collection container 2K may be configured as a unitary component so that the container portions 78, 79, and 80 are formed by longitudinally extending partitions. Collection container 2K might also be composed of three 15 narrow individual containers which are connected with one another by releasable locking means (not illustrated) to form a compact unit which can be placed onto the vehicle and can be released from it again. The filled individual containers can then be moved separately to different dumping locations.

20 The fill openings 11K of the container portions 78, 79, and 80 may be closed by separate closing flaps 81 once the containers have been released from the vehicle. Furthermore the rear wall of collection container is divided into three pivotable portions 4'. Accordingly, the three container

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portions can be filled and emptied separately. Although not shown in Figure 8, transfer region 40 should be subdivided above fill opening 11k by corresponding metal partitioning sheets if collection container 2K is to be used.

5 In order to prevent inadvertent mixing of the different types of trash in the fill region of the partitioned intermediate container 12K when trash containers are emptied, partitions (not illustrated) may also be disposed in the area enclosed by cover 46 (see Figure 9) above the intermediate 10 container, with the length of these partitions being variable to correspond to the lifting stroke.

In the embodiments shown in Figures 4, 5, 6, 8 and 10 for raising and lowering the intermediate container 12 in front of the dirver's cab 6 a lifting device could be used as it is known in principle from fork-lift-trucks. As shown schematically in Figure 16, this lifting device comprises at least one hydraulic cylinder 82, the free end of its piston rod 83 carries a roller 84. This roller 84 is working on a sprocket chain 85 with one end 86 fastened at a bottom part of the vehicle, the sprocket chain 85 passing over aforesaid roller 84 and with its other end 87 affixed to the lifting frame 24, so that the lifting frame can be moved vertically from its filling position in the bottom 25 region to the top region for coupling the intermediate container with the drive means.

The dumping apparatus 35 shown in Figure 6 can be adopted for all embodiments of the invention, where the intermediate container 12 is lifted vertically and than moved horizontally to the collection container 2. It is an adavntage of this dumping apparatus 35 in connection with the system of an intermediate container according to the invention, that both parts can move freely without any collisio during their respective movement.

10 It will be understood that the above description of the present invention is susceptible to various modifications, changes, and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

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1. A trash collection vehicle, comprising a vehicle with an operator station, namely:  
a motor vehicle having a driver's cab;  
a collection container carried by the vehicle behind the driver's cab, the collection container having an upper region with a fill opening and having a wall portion which can be opened for emptying;  
an intermediate container adjacent the driver's cab, the intermediate container having a fill opening for receiving trash and having a discharge opening which is separate from the fill opening of the intermediate container;  
emptying means, communicating with the intermediate container, for emptying the trash in the intermediate container into the fill opening of the collection container via the discharge opening of the intermediate container, the discharge opening of the intermediate container being in communication with the fill opening of the collection container at least when the trash is being emptied by the emptying means; and  
compacting means for compacting the trash in the collection container.

2. The trash collection vehicle of claim 1, wherein the trash is received at the fill opening of the intermediate

container from trash containers, and further comprising manipulating means, communicating with the intermediate container, for manipulating the trash containers.

3. The trash collection vehicle of claim 1 or 2, further comprising means for closing at least one of the fill opening of the collection container and the discharge opening of the intermediate container.

4. The trash collection vehicle of claim 1 to 3, further comprising means for subdividing the intermediate container into a plurality of container portions, each container portion of the intermediate container having a respective discharge opening.

5. The trash collection vehicle of claim 1 to 4, wherein at least one of the discharge opening of the intermediate container and the fill opening of the collection container is provided at an extending portion of the respective container, the extending portion projecting into the other container at least when trash is being emptied by the emptying means.

6. The trash collection vehicle of claim 1 to 5, wherein the collection container is elongated and has a longitudinal

axis, and wherein the compacting means comprises a pusher that is movably mounted in the collection container, the pusher having a surface which is oriented transversely to the longitudinal axis of the collection container, and actuation mechanism means for moving the pusher in the longitudinal direction of the collection container.

7. The trash collection vehicle of claim 1 to 6, further comprising extendable ground supports on the collection container.

8. The trash collection vehicle of claim 1 to 7, wherein the collection container comprises subdivision means for subdividing the collection container into a plurality of container portions, each container portion having its own fill opening.

9. The trash collection vehicle of claim 8, wherein the subdivision means comprises means releasably connected to the vehicle for forming at least one of the container portions.

10. The trash collection container of claim 8, wherein the collection container includes a plurality of wall

portions which can be opened for emptying, each container portion having a respective one of the wall portions which can be opened for emptying, and wherein the compacting means comprises a plurality of pushers, each pusher being disposed in a respective container portion and facing the respective wall portion thereof which can be opening for emptying.

11. The trash collection vehicle of claim 1 to 10, wherein the trash is received at the fill opening of the intermediate container from trash containers, wherein the intermediate container is disposed above the driver's cab, and further comprising means for manipulating the trash containers, the means for manipulating including a trash container holder and elevating means for raising the holder, the elevating means including a portion which extends toward the ground in front of the driver's cab.

12. The trash collection vehicle of claim 1 to 11, further comprising guide means for guiding the intermediate container for back and forth motion over the driver's cab, from a forward position to an emptying position at the collection container.

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13. The trash collection vehicle of claim 1 to 12, further comprising displacement means connected to the vehicle for moving the intermediate container over the driver's cab from a fill position adjacent the ground in front of the driver's cab to an emptying position at the collection container.

14. The trash collection vehicle of claim 1 to 13, wherein the intermediate container is exchangeably connected with the displacement means.

15. The trash collection vehicle of claim 1 to 14, further comprising a pulverizing apparatus connected to the displacement means.

16. The trash collection vehicle of claim 1 to 15, wherein the displacement means comprises first means disposed at the front of the driver's cab for moving the intermediate container along a generally vertical path, and second means for moving the intermediate container along a generally horizontal path above the driver's cab.

17. The trash collection vehicle of claim 1 to 16, further comprising a supporting frame connected to the motor vehicle

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to support the displacement means, the support frame having a front portion which carries the first means of the displacement means and having an upper portion which is disposed above the driver's cab and which carries the second means of the displacement means.

18. The trash collection vehicle of claim 1 to 17, wherein the front portion of the supporting frame is connected to the vehicle by way of a plurality of front fastening points, and wherein the upper portion of the supporting frame has a rear end that is connected to the vehicle by way of a rear fastening point.

19. The trash collection vehicle of claim 1 to 18, wherein the rear fastening point is releasable, and wherein the supporting frame is mounted at the front fastening points so as to be pivotable about a generally horizontal axis.

20. The trash collection vehicle of claim 1 to 19, wherein the second means comprises a guide extending to the emptying position, the emptying position being adjacent the fill opening of the collection container.

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21. The trash collection vehicle of claim 1 to 20, wherein the intermediate container includes a lockable closure for the discharge opening of the intermediate container, and further comprising actuating means, disposed at the guide adjacent the emptying position, for unlocking the closure.

22. The trash collection vehicle of claim 1 to 21, wherein the intermediate container has an open top that provides the fill opening of the intermediate container, and further comprising a carriage-like pressure plate which is movably disposed at the guide so as to close off the open top of the intermediate container when the intermediate container is in a raised position.

23. The trash collection vehicle of claim 1 to 22, wherein the second means further comprises propelling means for propelling the intermediate container along the guide from a forward position to the emptying position at the collection container and back again.

24. The trash collection vehicle of claim 1 to 23, wherein the intermediate container has an open top that provides the fill opening of the intermediate container, and wherein the propelling means comprises a carriage-like pressure plate

which is movably disposed at the guide so as to close off the open top of the intermediate container when the intermediate container is in a raised position, and releasable connecting means for coupling the carriage-like pressure plate to the intermediate container.

25. The trash collection vehicle of claim 1 to 24, wherein a portion of the guide has a channel-like configuration, with a front entrance opening for the intermediate container and with a discharge opening which can be sealed to the fill opening of the collection container.

26. The trash collection vehicle of claim 1 to 25, further comprising a cover for shielding the space between the guide and the intermediate container in its filling position, the cover having a length that is variable in dependence on the distance between the guide and the intermediate container, the cover having a rear portion which faces the driver's cab and having side portions adjacent the rear portion.

27. The trash collection vehicle of claim 1 to 26, wherein the intermediate container further comprises means for subdividing the intermediate container into a plurality of intermediate container portions, and wherein the cover

further comprises means for subdividing the space shielded by the cover to provide a plurality of shielded portions, each shielded portion communicating with a respective intermediate container portion, the means for subdividing the space shielded by the cover including at least one partition having a length that is variable in dependence on the distance between the guide and the intermediate container.

28. The trash collection vehicle of claim 1 to 27, wherein the cover has an upper end which is fastened to the carriage-like pressure plate and a lower end which is fastened to the intermediate container, the cover being movable along the guide with the carriage-like pressure plate and the intermediate container.

29. The trash collection vehicle of claim 1 to 28, wherein the trash is received at the fill opening of the intermediate container from trash containers, wherein the trash collection vehicle further comprises a pivotably mounted holder to dump the trash from a trash container into the intermediate chamber when the intermediate container is in its filling position, and wherein the cover further comprises an additional portion which is openable to permit the holder to dump trash from a trash container.

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30. The trash collection vehicle of claim 1 to 29, further comprising a supporting frame connected to the motor vehicle to support the displacement means, the supporting frame having a front portion which carries the first means of the displacement means, the support frame additionally having an upper portion which is disposed above the driver's cab and which carries the guide and the propelling means of the second means of the displacement means.

31. The trash collection vehicle of claim 1 to 30, wherein the front portion of the supporting frame is connected to the vehicle by way of a plurality of front fastening points, and wherein the upper portion of the supporting frame has a rear end that is connected to the vehicle by way of a rear fastening point.

32. The trash collection vehicle of claim 1 to 31, further comprising a joint at the rear fastening point, the joint having at least two degrees of freedom.

33. The trash collection vehicle of claim 1 to 32, wherein the rear fastening point is releasable, and wherein the

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supporting frame is mounted at the front fastening point so as to be pivotable about a generally horizontal axis.

34. The trash collection vehicle of claim 1 to 33, further comprising pivot drive means for controllably pivoting the supporting frame.

35. The trash collection vehicle of claim 1 to 34, wherein the supporting frame is releasably connected to the vehicle.

36. The trash collection vehicle of claim 1 to 35, wherein the intermediate container has a rear end and the discharge opening of the intermediate container is disposed at the rear end of the intermediate container, and wherein the emptying means comprises a discharging apparatus which is movable toward the discharge opening.

37. The trash collection vehicle of claim 1 to 36, wherein the intermediate container has a bottom side and the discharge opening of the intermediate container is disposed in the bottom side of the intermediate container.

38. The trash collection vehicle of claim 1 to 37, wherein the trash is received at the fill opening of the intermediate container from trash containers, and further comprising means for manipulating the trash containers, the means for manipulating including a controllable pickup and emptying mechanism disposed at the front of the driver's cab.

39. The trash collection vehicle of claim 1 to 38, wherein the controllable pickup and emptying mechanism is mounted so as to be pivotable about a generally vertical axis, and includes a trash container gripper mechanism, and mounting means, including at least one arm, for holding the gripper mechanism at a variable distance from the generally vertical axis, the gripper mechanism being held by the mounting means so that the gripper mechanism is pivotable about an axis that is orthogonal to the generally vertical axis.

40. The trash collection vehicle of claim 1 to 39, wherein the motor vehicle has a longitudinal side and the collection container has a front end that is oriented toward the driver's cab, and wherein a protected worker station is disposed between the driver's cab and the front end of the collection container on the longitudinal side of the motor vehicle.

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41. The trash collection vehicle of claim 1 to 40, wherein the collection container has a front end that is oriented toward the driver's cab, and wherein the fill opening of the intermediate container is located in front of the front end of the collection container when the fill opening of the intermediate container receives trash.

- 1 / 14 -

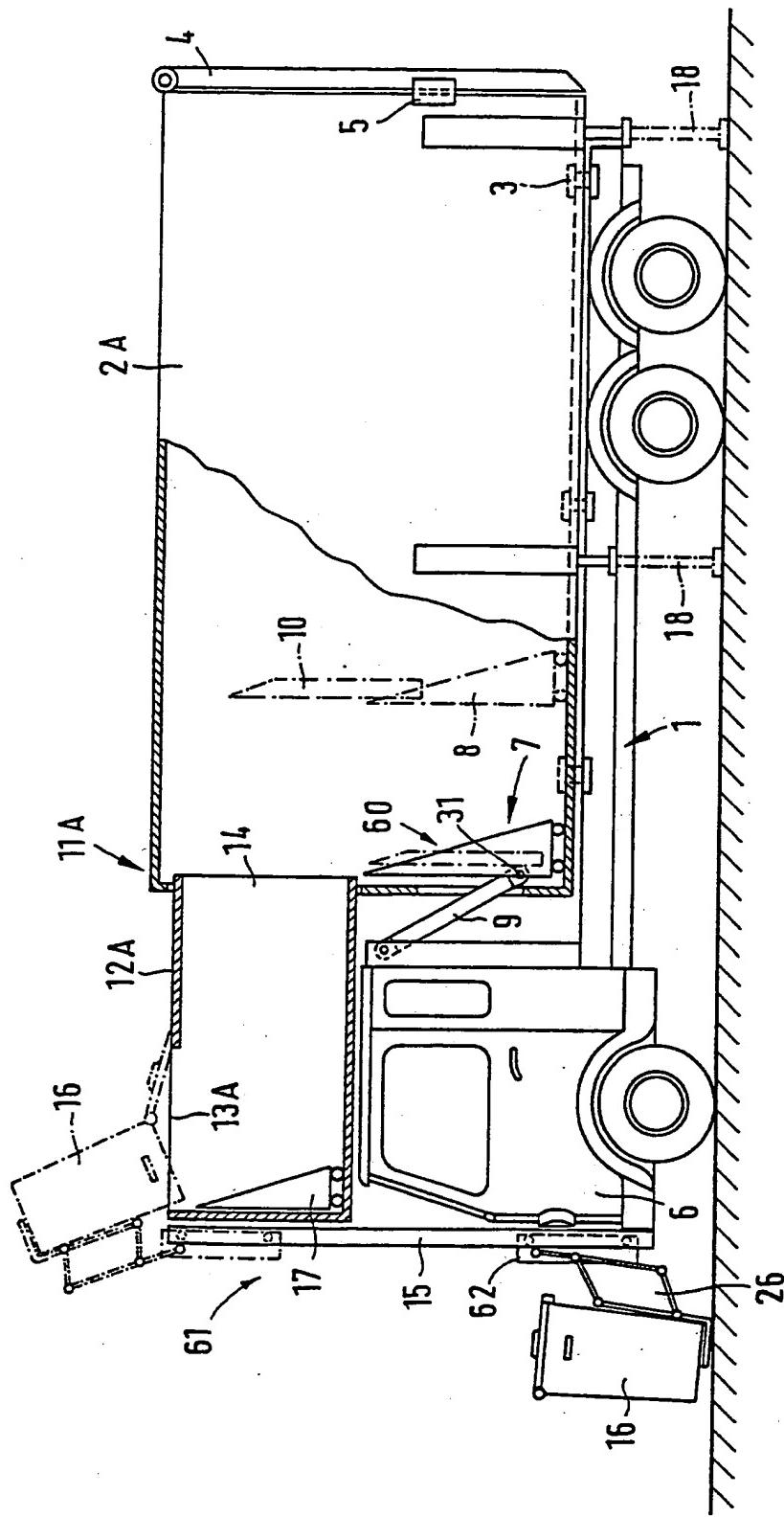


FIG. 1

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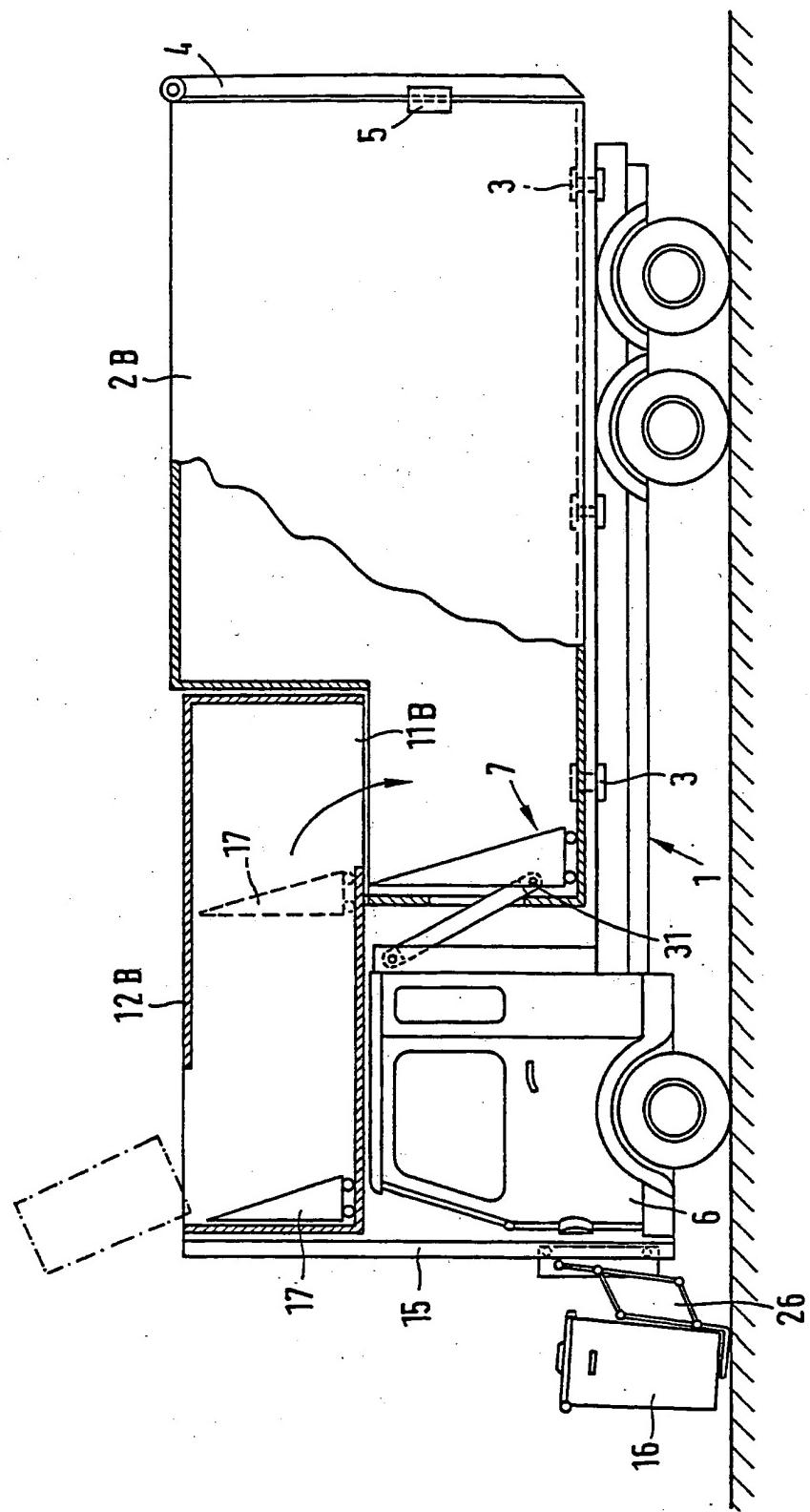


FIG. 2

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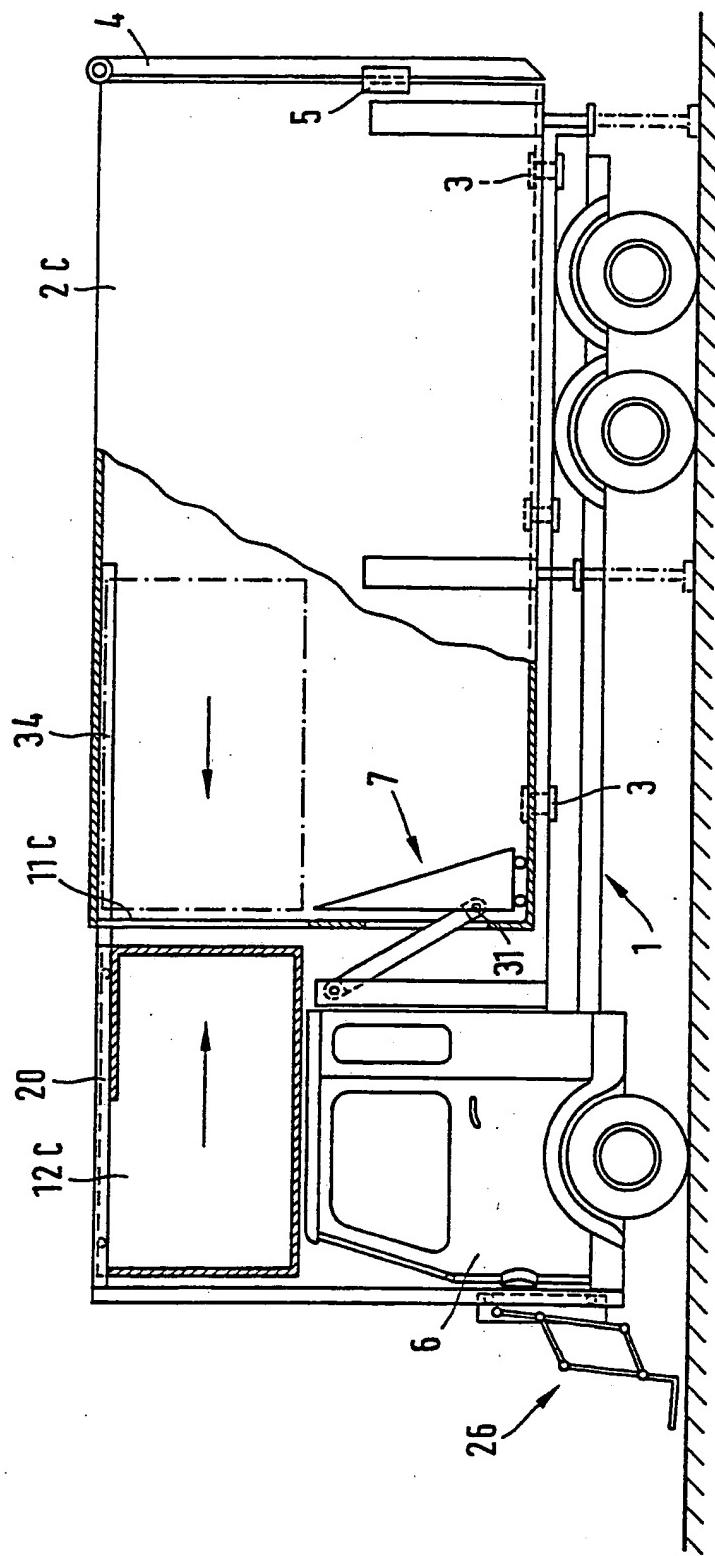
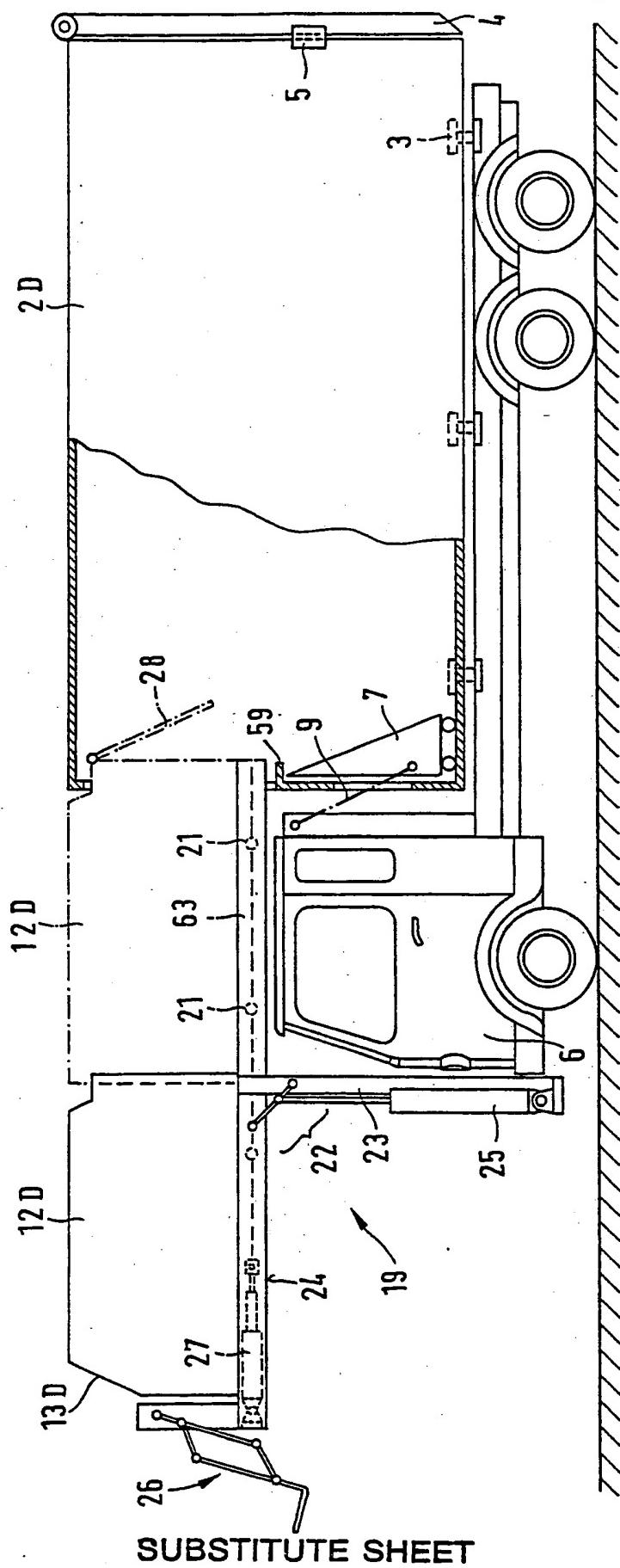


FIG. 3

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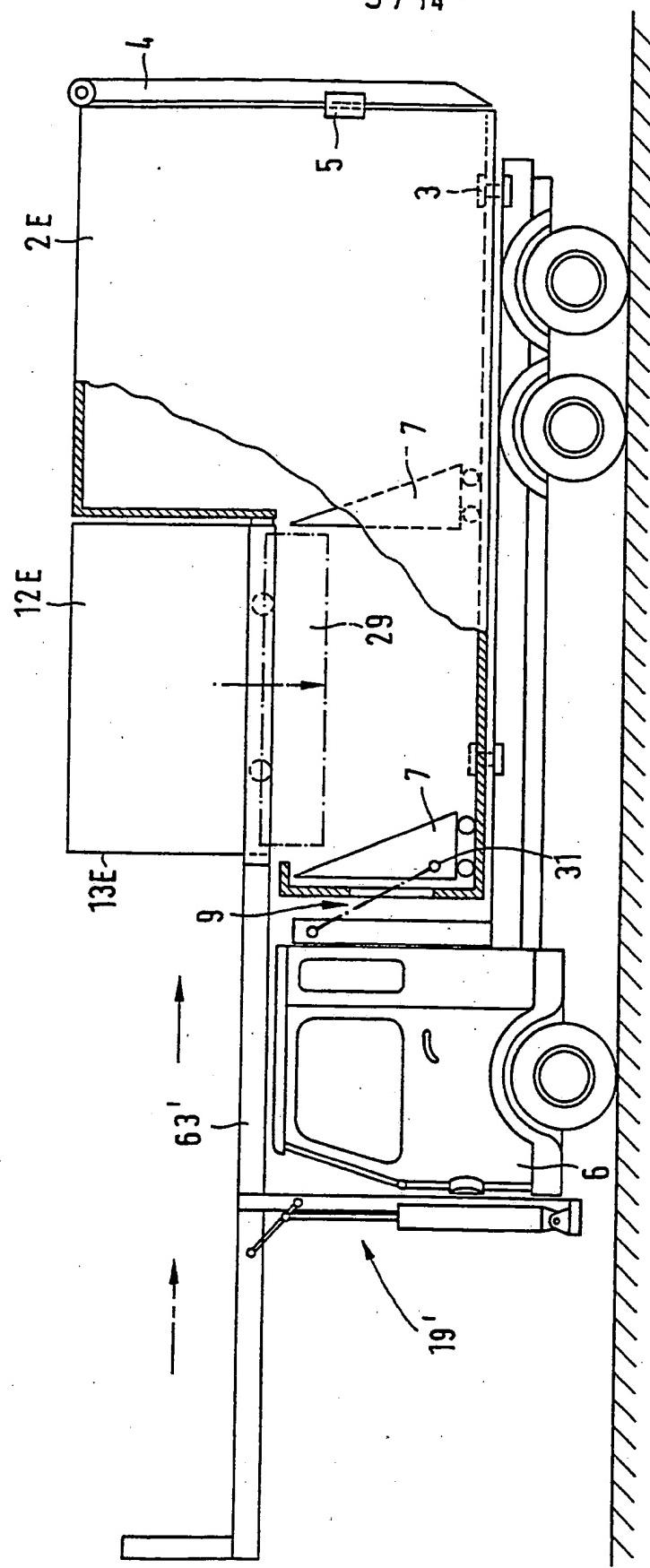


FIG. 5

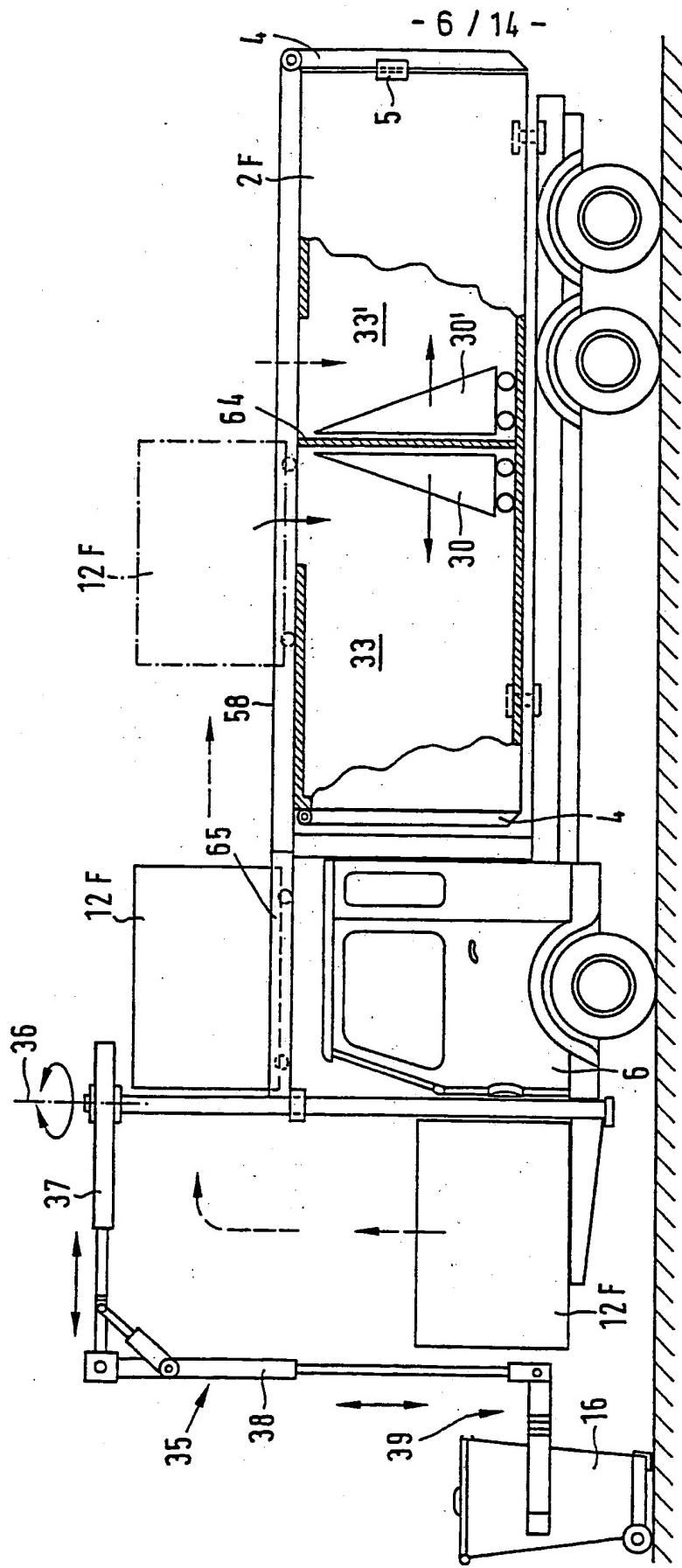
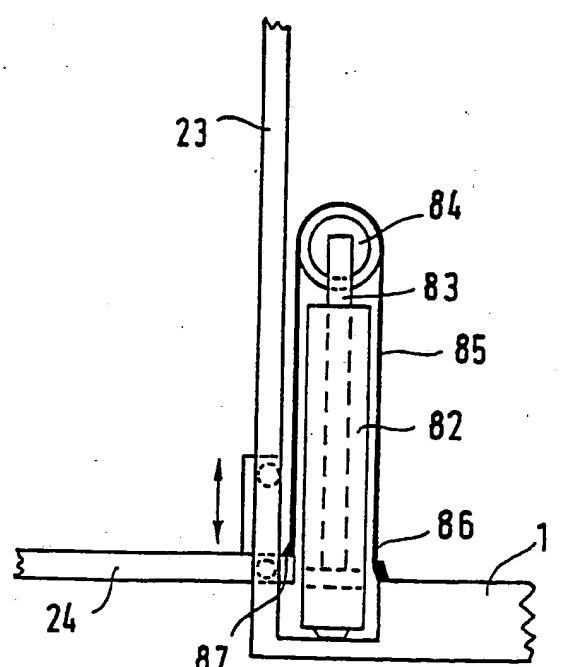
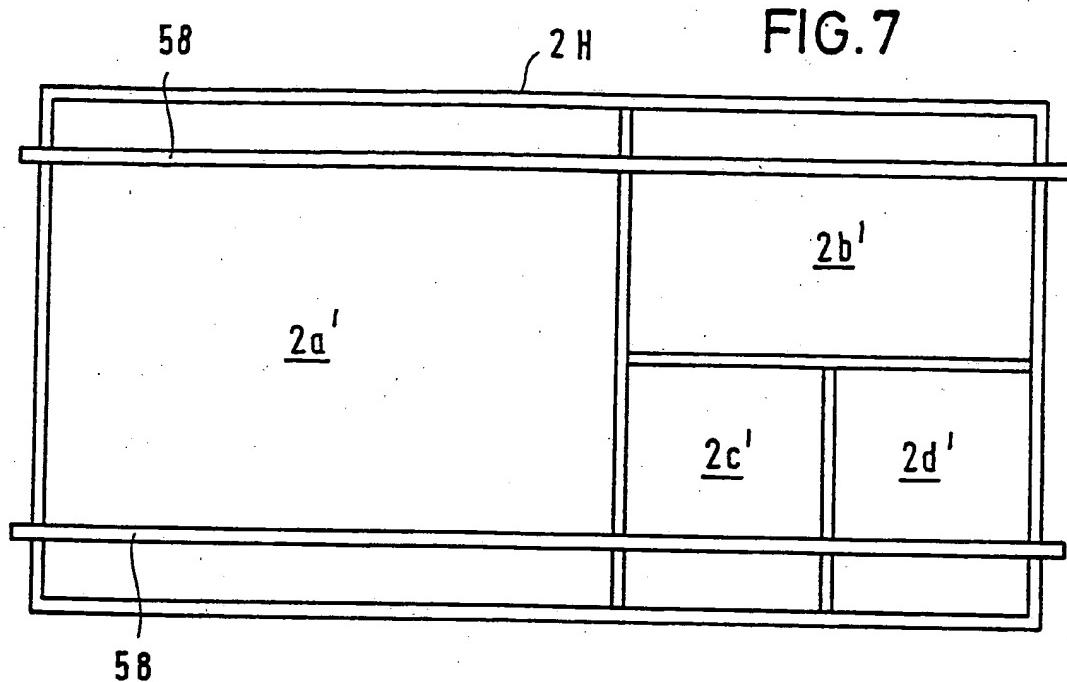


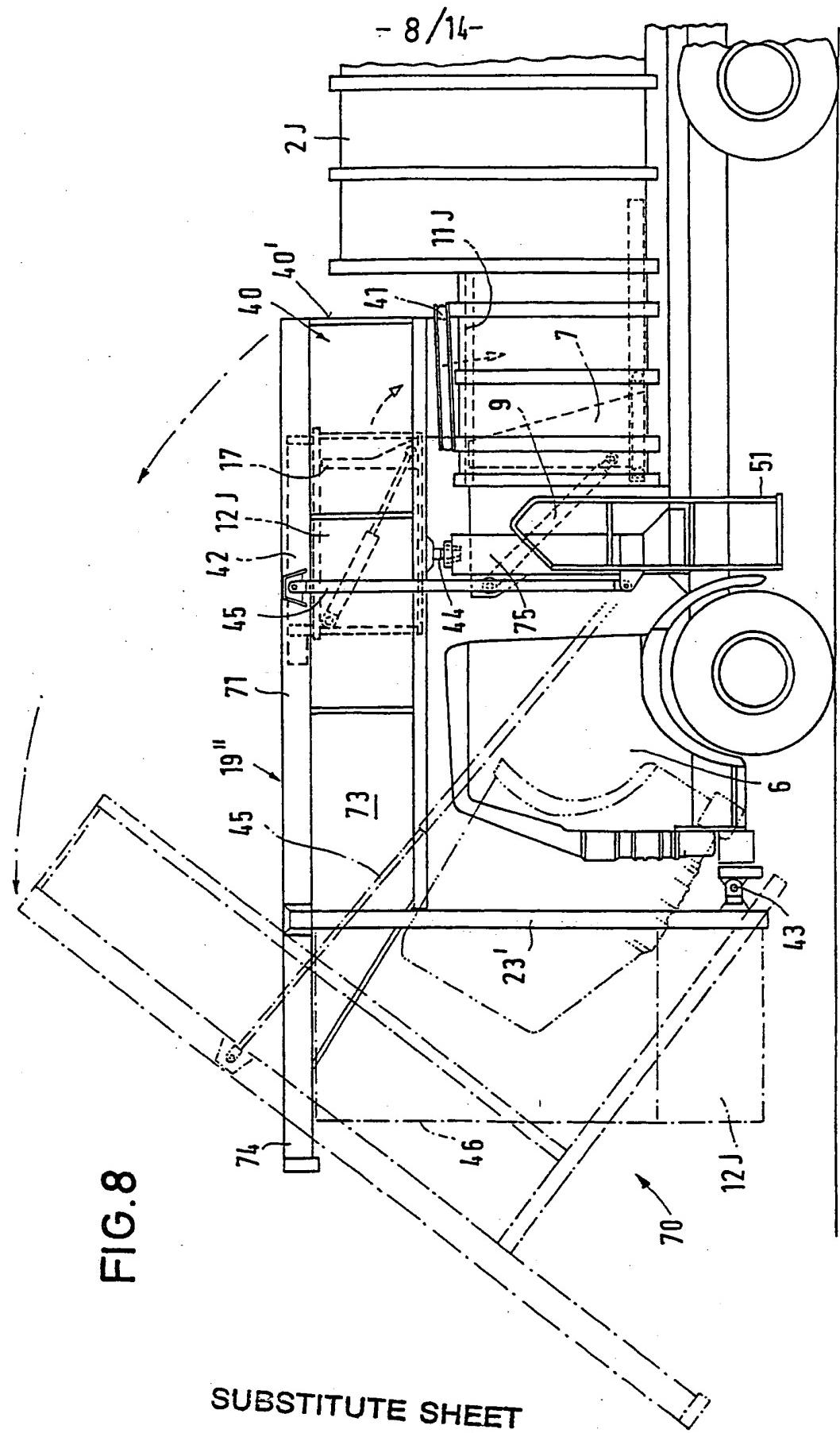
FIG. 6

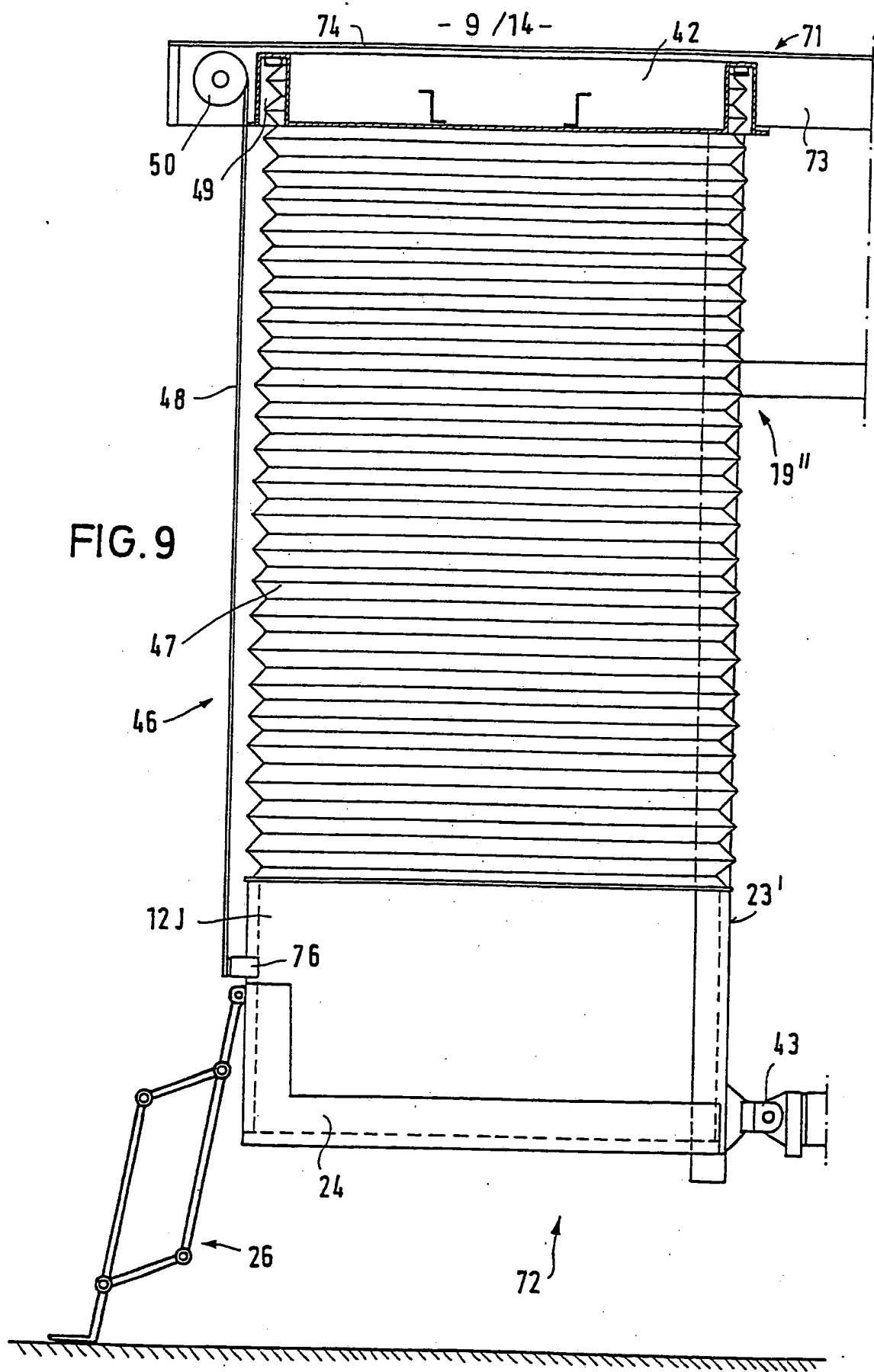
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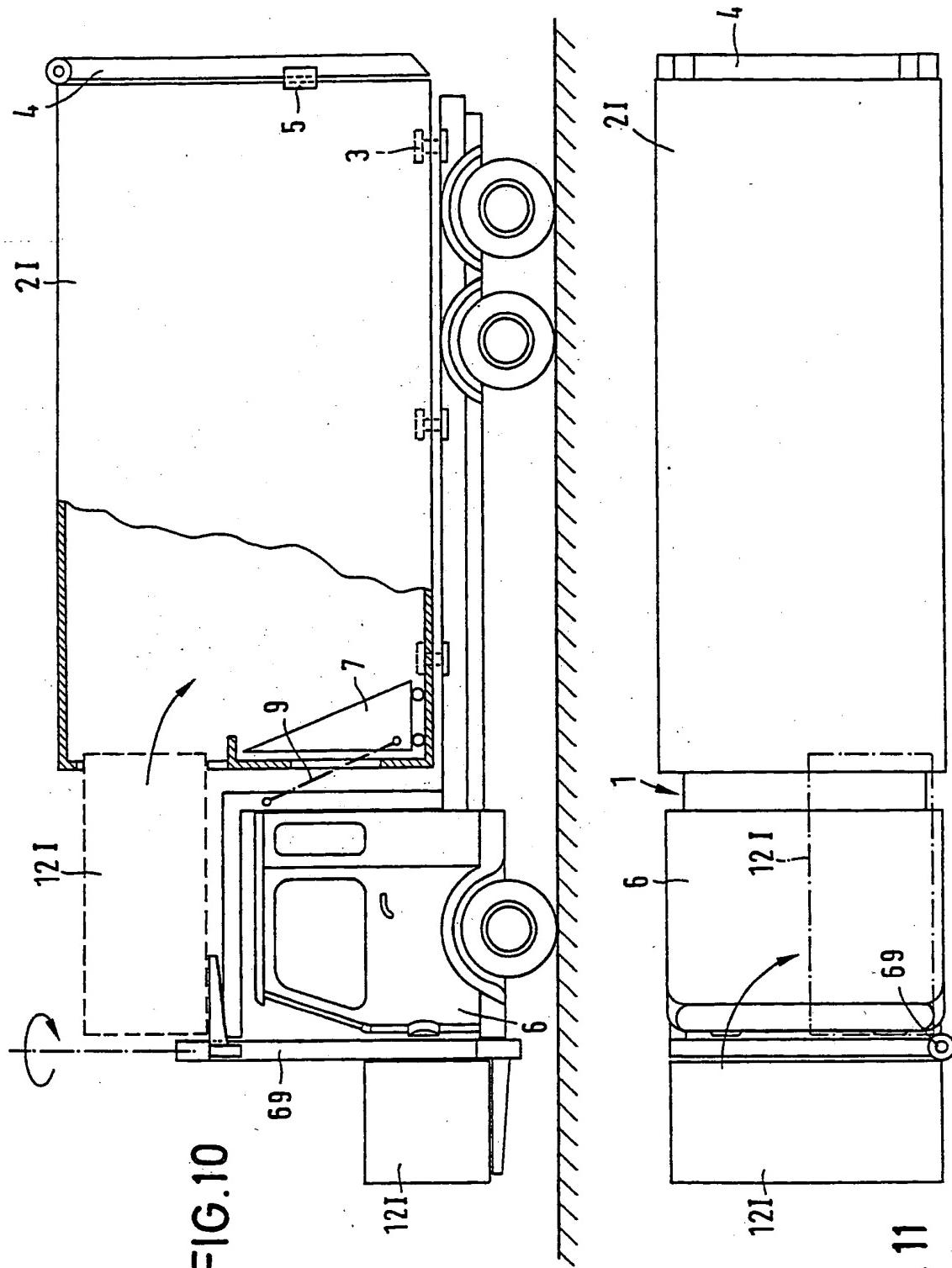


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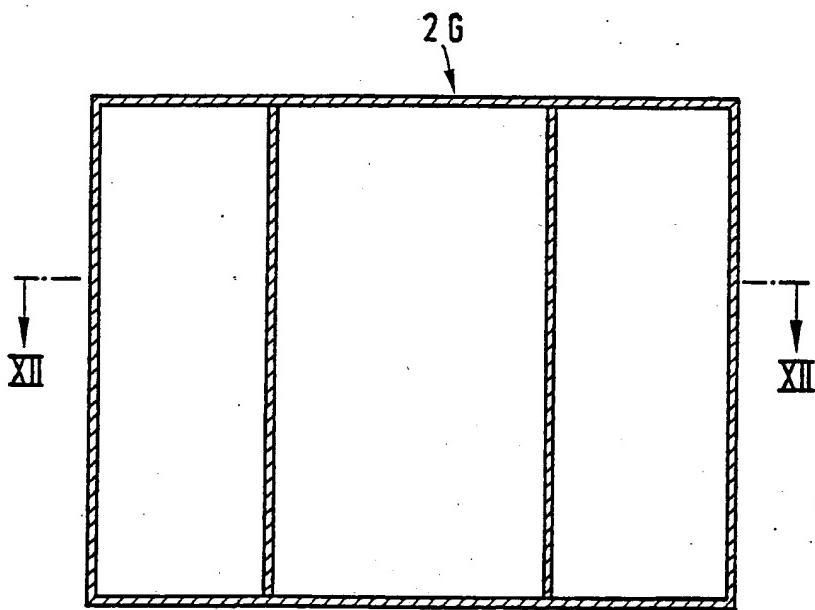
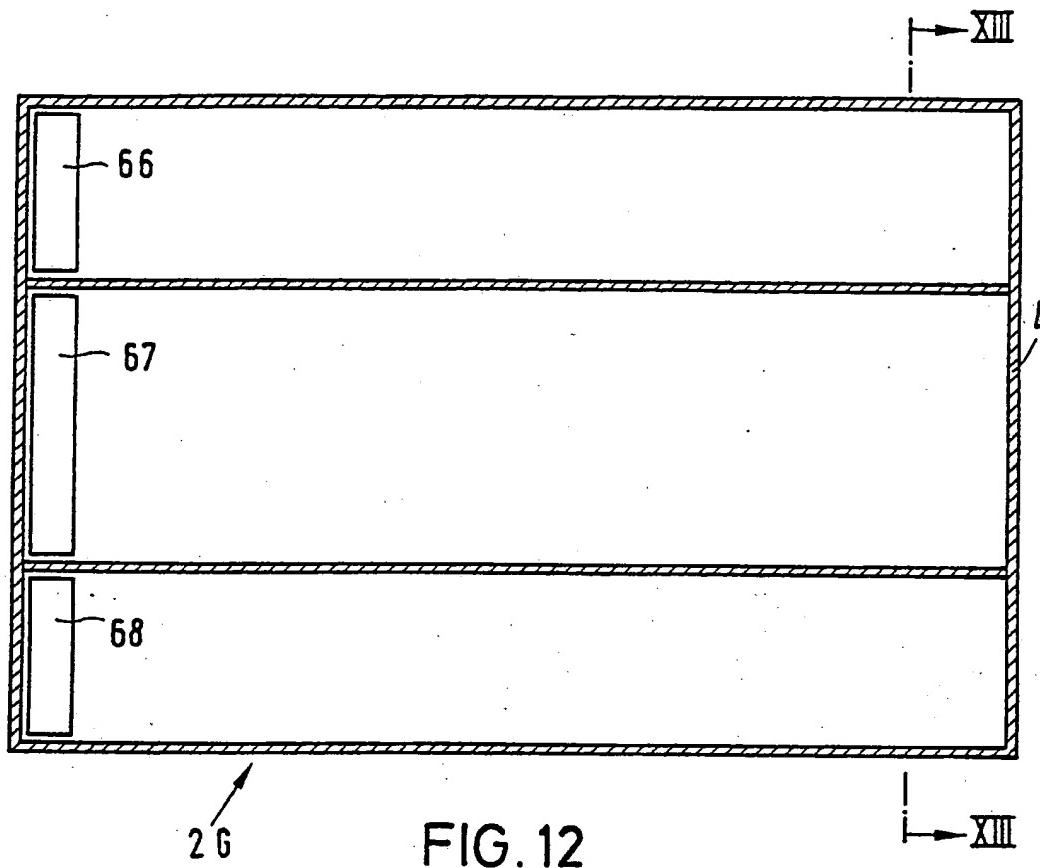


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FIG.14 A

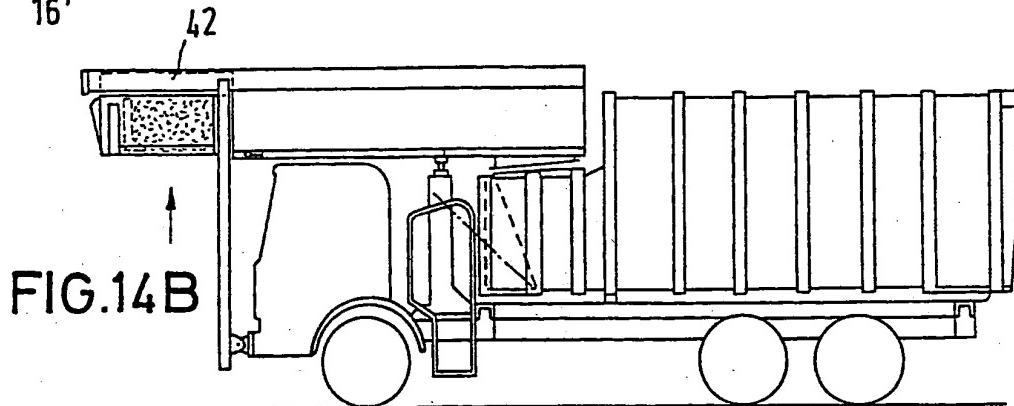
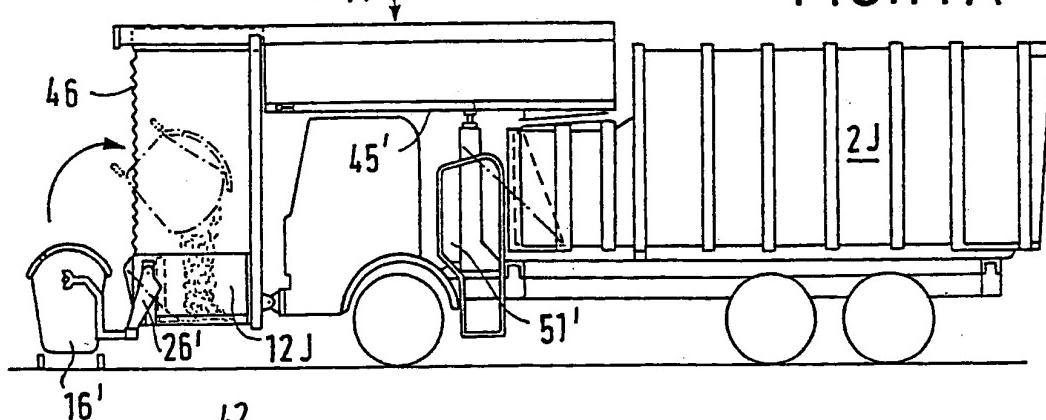


FIG.14 B

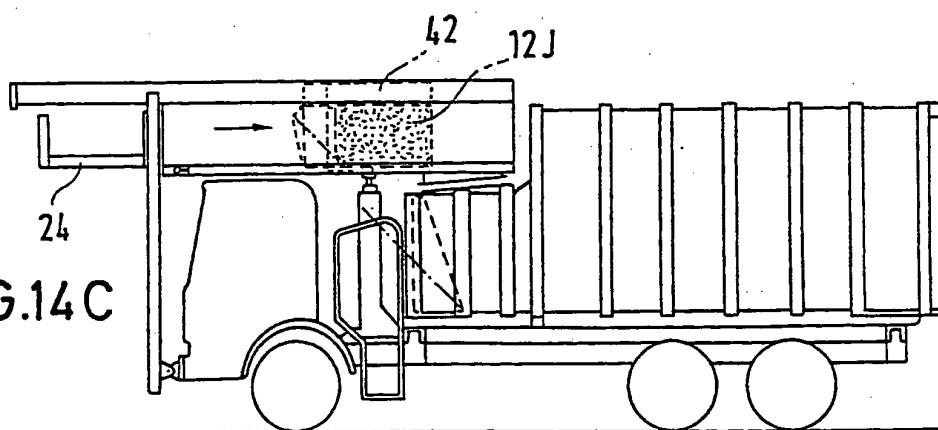


FIG.14 C

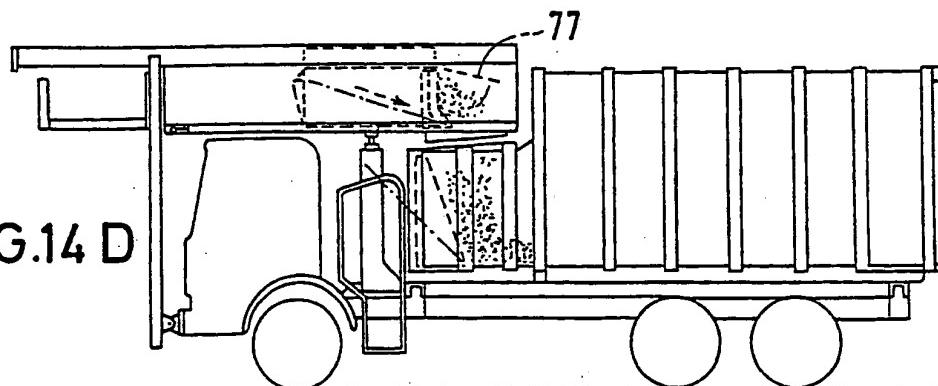


FIG.14 D

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FIG.14 E

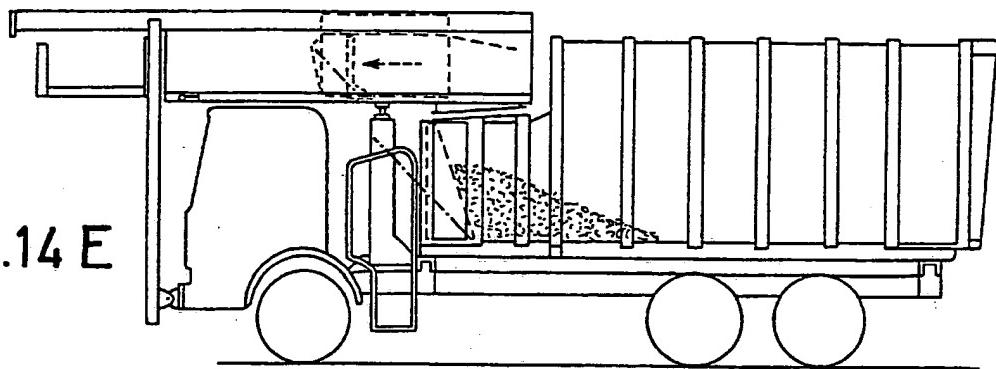
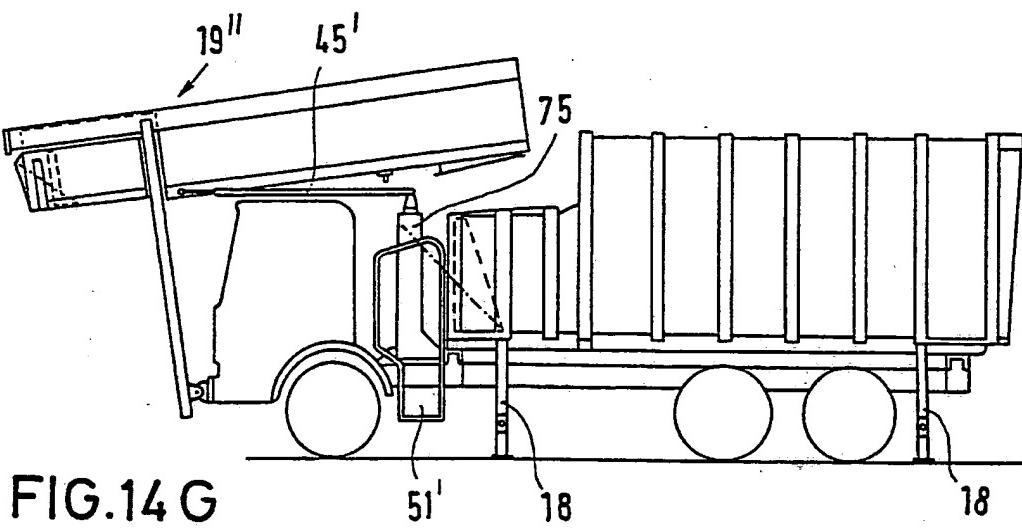
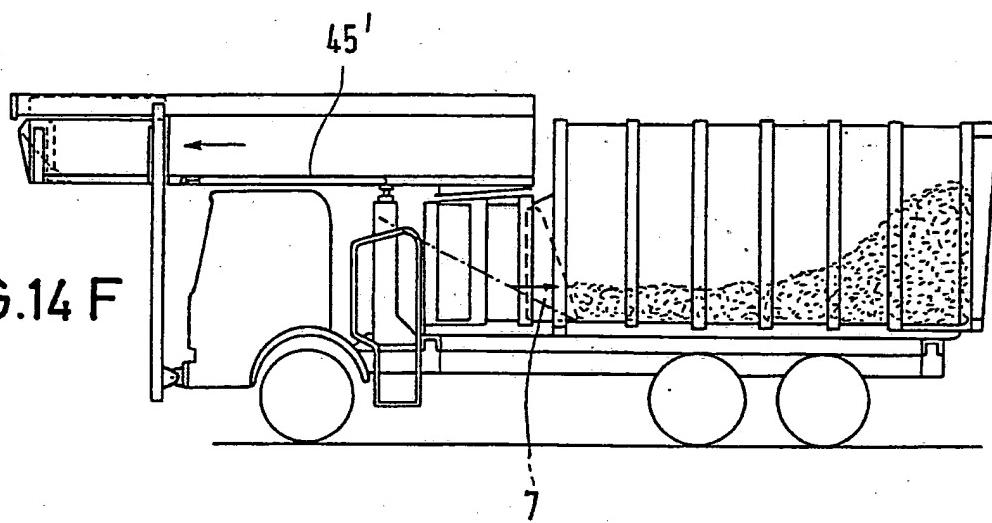


FIG.14 F



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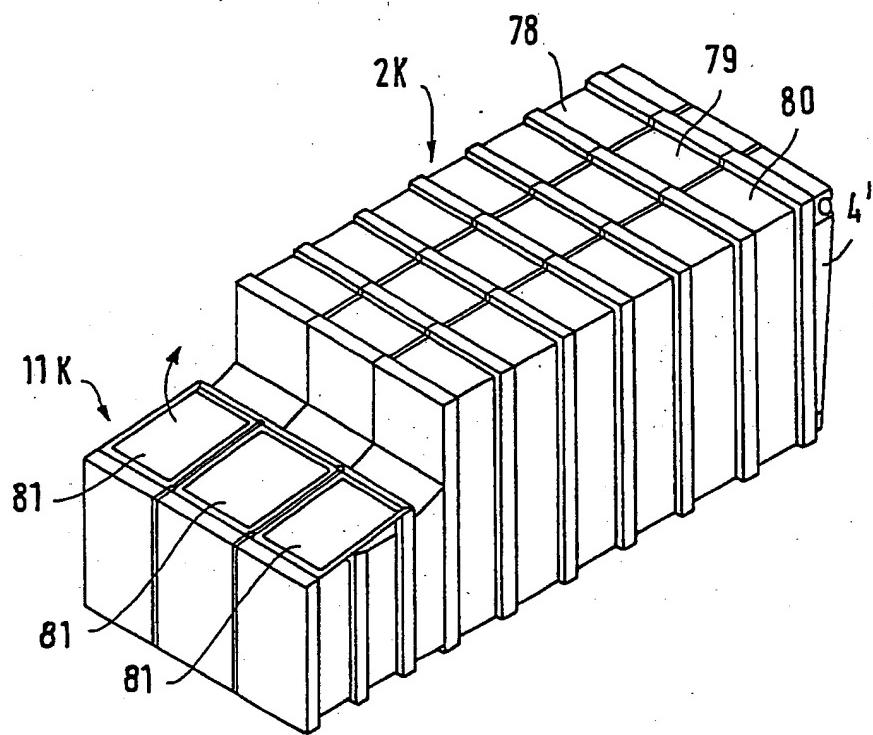


FIG.15

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# INTERNATIONAL SEARCH REPORT

International Application No. PCT/EP 90/00992

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) \*

According to International Patent Classification (IPC) or to both National Classification and IPC

**IPC<sup>5</sup>**: B 65 F 3/04, B 65 F 3/02, B 65 F 3/28

## II. FIELDS SEARCHED

Classification System	Classification Symbols	Minimum Documentation Searched ?
		Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *
<b>IPC<sup>5</sup></b>	B 65 F, B 60 P	

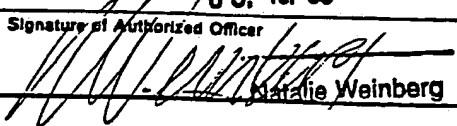
## III. DOCUMENTS CONSIDERED TO BE RELEVANT \*

Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages	Relevant to Claim No. 12
A	US, A, 3762586 (UPDIKE, Jr.) 2 October 1973 see figures 1,4; column 3, lines 4-23; column 4, lines 14-61	1
A	GB, A, 837021 (THURGOOD) 9 June 1960	--
A	DE, A, 2545051 (SCHAFFLER) 14 April 1977 & US, A, 4096959 (cited in the application)	--
A	DE, A, 3537546 (KNIERIM) 23 April 1987	--

- \* Special categories of cited documents: <sup>10</sup>
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "Z" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
3rd September 1990	10 3, 10. 90
International Searching Authority <b>EUROPEAN PATENT OFFICE</b>	Signature of Authorized Officer  Natalie Weinberg

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

**EP 9000992  
SA 38286**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the European Patent Office EDP file on 24/09/90  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 3762586	02-10-73	None		
GB-A- 837021		None		
DE-A- 2545051	14-04-77	FR-A, B JP-A- NL-A- SE-A- US-A-	2327166 52047219 7610914 7611070 4096959	06-05-77 14-04-77 13-04-77 09-04-77 27-06-78
DE-A- 3537546	23-04-87	None		